Railway Engineering and Maintenance

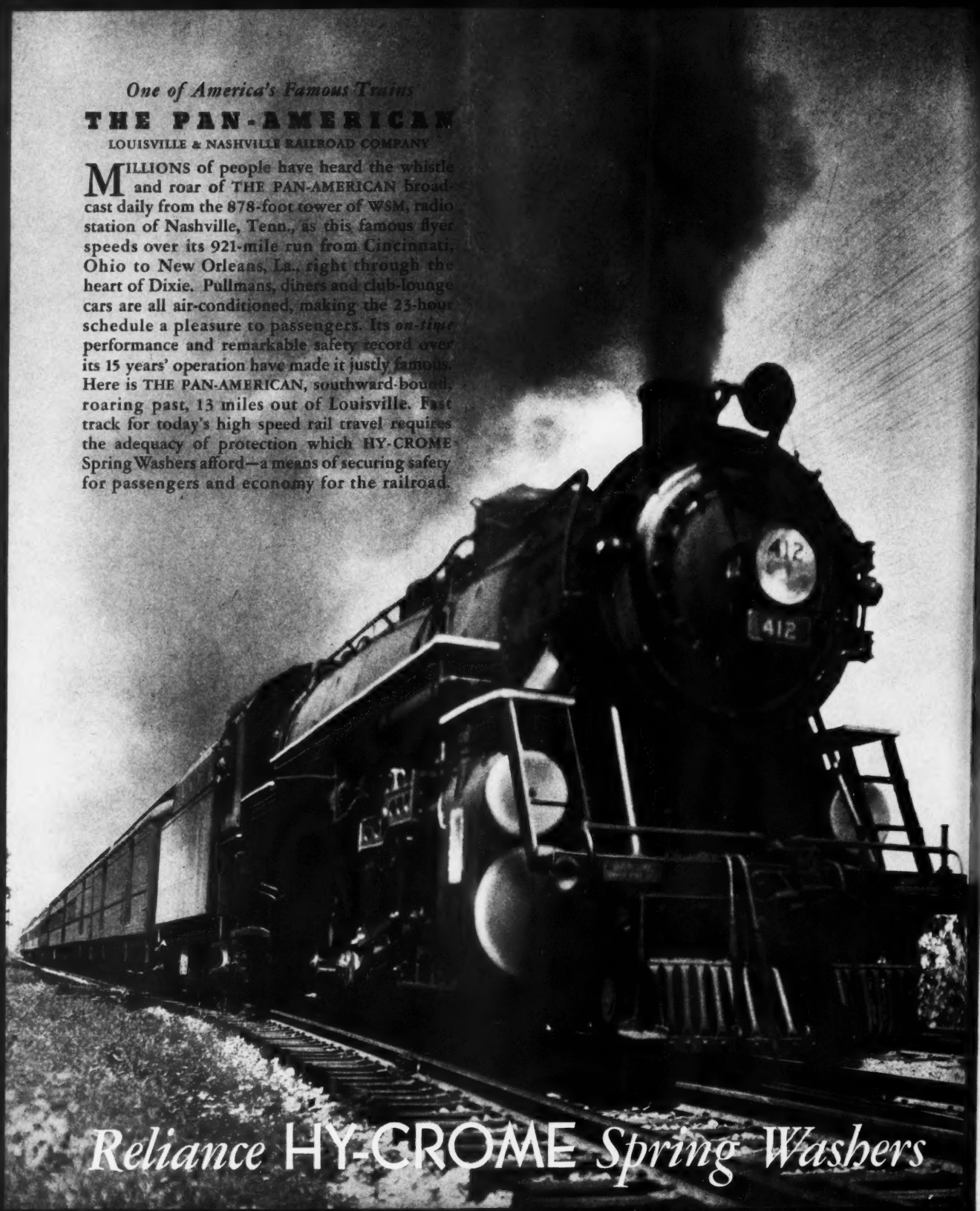
E NATIONAL LOCK WASHER COMPANY
NEWARK, NEW JERSEY

One of America's Famous Trains

THE PAN-AMERICAN

LOUISVILLE & NASHVILLE RAILROAD COMPANY

MILLIONS of people have heard the whistle and roar of THE PAN-AMERICAN broadcast daily from the 878-foot tower of WSM, radio station of Nashville, Tenn., as this famous flyer speeds over its 921-mile run from Cincinnati, Ohio to New Orleans, La., right through the heart of Dixie. Pullmans, diners and club-lounge cars are all air-conditioned, making the 23-hour schedule a pleasure to passengers. Its *on-time* performance and remarkable safety record over its 15 years' operation have made it justly famous. Here is THE PAN-AMERICAN, southward-bound, roaring past, 13 miles out of Louisville. Fast track for today's high speed rail travel requires the adequacy of protection which HY-CROME Spring Washers afford—a means of securing safety for passengers and economy for the railroad.



Reliance HY-CROME *Spring Washers*

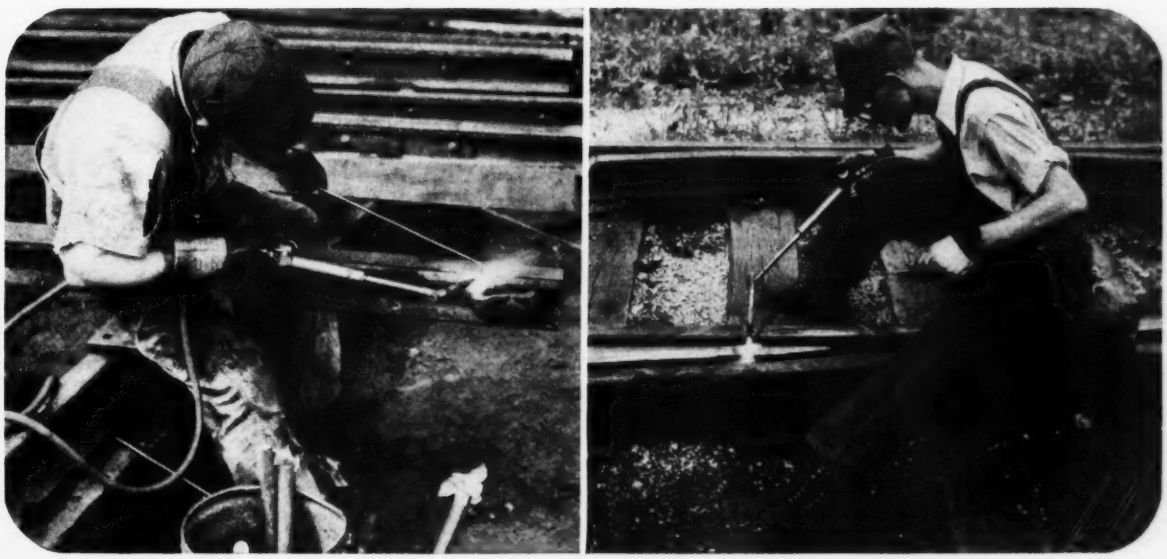
· REActive Deflected	THACKERAY	HY-REACTION	STANDARD	HEAVY DUTY	DOUBLE	BOND
leets A. R. E. A. Spec.	*For screw spike use*	*For track bolts*	*For general use*	*For frogs—crossings*	*For special use*	*Used as*

CHICAGO

EATON MANUFACTURING CO. RELIANCE SPRING WASHER DIVISION, MASSILLON, O

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

OXWELDING
reduces switch point and frog maintenance



IN OR OUT OF TRACK—Frogs and switch points can be oxwelded in track or where changing-out is possible can be brought to a central shop for building up. Either method is effective when done under Oxweld procedures.

● Modern high speed train service inflicts severe penalties on switch points and frogs. Wear is rapid, yet safety standards demand that these vital portions of track be kept at a high degree of operating efficiency. To meet these new conditions, many of the leading railroads have turned to oxwelding as a ready means of restoring worn switch points and frogs at relatively small cost.

Oxwelding makes worn switch points and frogs equal to new, enables them to withstand better the wear of heavy traffic. Upkeep costs are lowered. The roads requirements of new replacement units are substantially reduced by this simple, easy and economical method of repair.

The Oxweld Railroad Service Company has developed low cost methods and techniques of making switch point and frog repairs and extends the fullest cooperation to its railroad clients in organizing this work, in or out of track. The majority of Class I railroads have been Oxweld clients for nearly a quarter of a century.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation

UCC

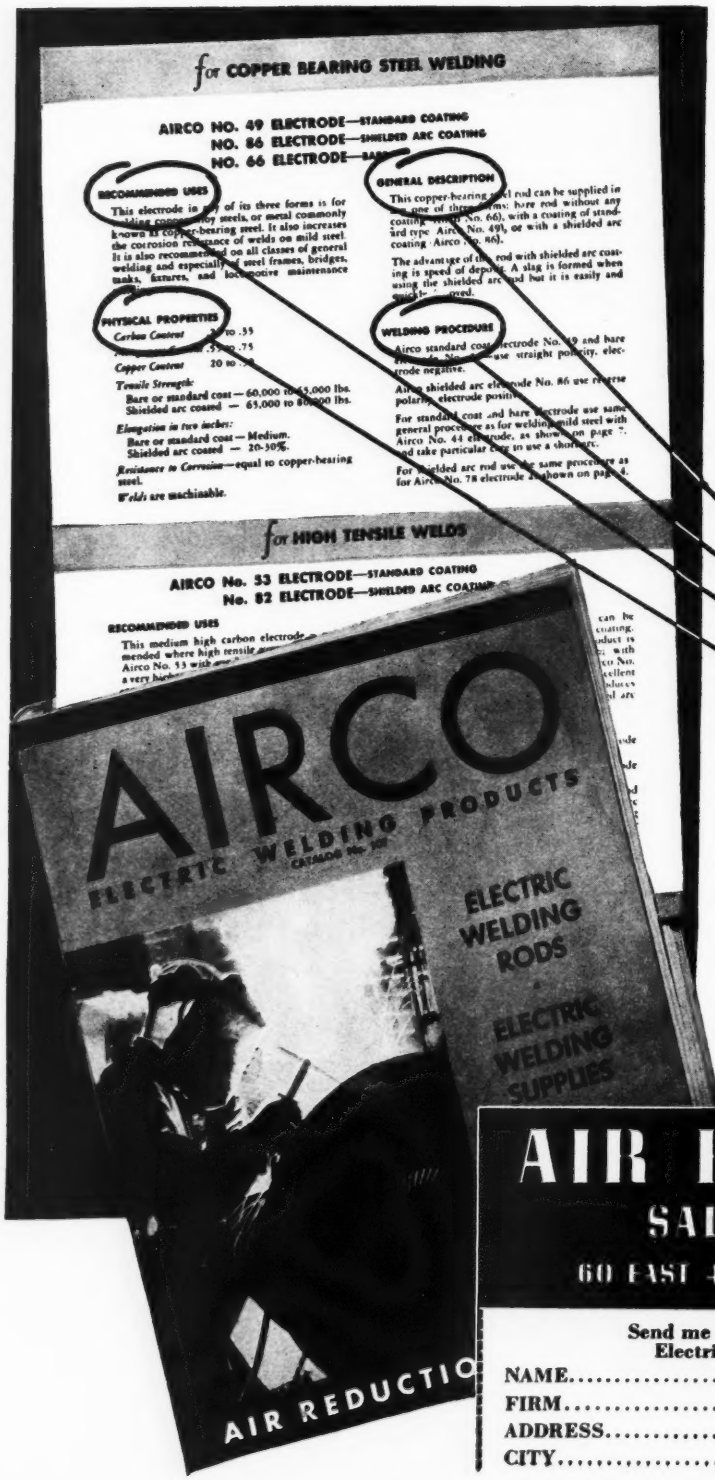
NEW YORK:
Carbide and Carbon Bldg.

CHICAGO:
Carbide and Carbon Bldg.

OXWELD RAILROAD SERVICE

Published monthly by Simmons-Boardman Publishing Company, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

Ask for AIRCO'S New CATALOG of ELECTRIC ARC WELDING Products



And it's really more than just a catalog.

There are 32 big full-size pages containing a wealth of information about electrodes—

GENERAL DESCRIPTIONS
WELDING PROCEDURE
RECOMMENDED USES
PHYSICAL PROPERTIES

— and other electric welding data.

Also well illustrated and described are electric arc welding machines, helmets, face shields, electrode holders, cable, etc.

If you are using the electric arc welding process, or even considering its use, you should request a copy.

MAIL the COUPON TODAY

AIR REDUCTION SALES COMPANY

60 EAST 42nd ST., NEW YORK CITY

Send me a complimentary copy of your new Electric Arc Welding Products Catalog R311

NAME.....

FIRM.....

ADDRESS.....

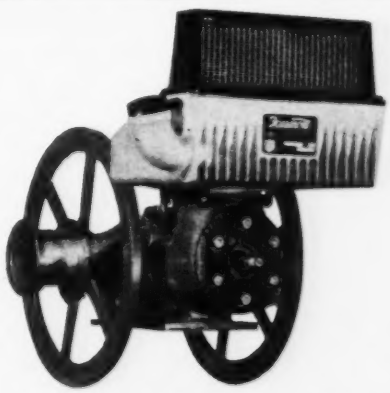
CITY.....STATE.....

59 SERIES B

Trouble-Shooting or Section Service

● From carrying one or two men on inspection to full duty in the lighter division of section work . . . that is the performance record of this Fairmont 59. This unusual range of service is the result of great lightweight strength in the sturdy oak frame combined with skillful design for the safe carrying of bulky loads. Its cushioned riding comfort and easy off-and-on handling are features that make it the choice of linemen, signalmen and inspection men, and—in every branch of service—it is noted for the surplus power furnished by the famous Fairmont power plant, the Model 0 (5-8 H.P.) Engine. The husky durability and the husky power of this car are matched by its simplicity of design for easy care and dependable operation.

FAIRMONT RAILWAY MOTORS, Inc., Fairmont, Minn.



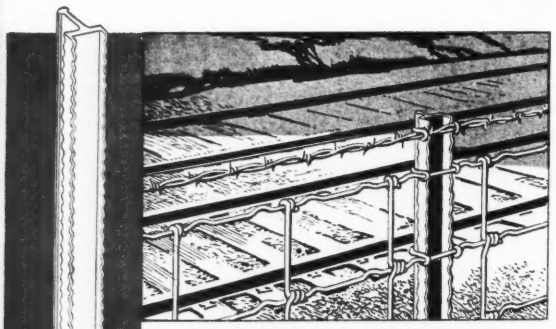
The power and simplicity of the Fairmont Model 0 Engine has justified its application to six Fairmont cars.

Performance ON THE JOB COUNTS

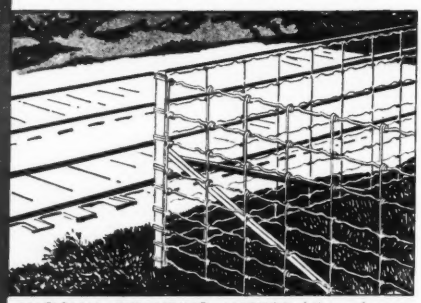
Fairmont

Inspection Motor Cars . . . Section Motor Cars . . . B & B and Extra Gang Cars . . . Gas-Electric Ditchers . . . Shapers . . . Ballast Cleaners . . . Ballast Drainage Cars . . . Mowers . . . Weed Burners . . . Extinguisher Cars . . . Power Cars: Air, Electric, Paint Spray, Tie Tamping . . . Rail Coaches . . . Motor Car Engines . . . Push Cars and

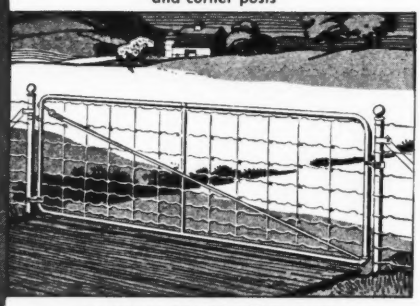
NO TRESPASSING



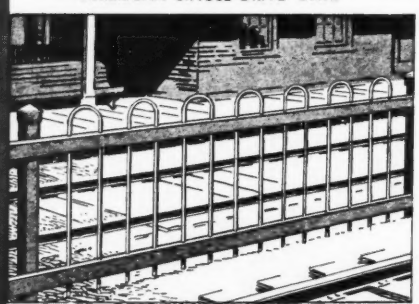
AMERICAN FENCE with barbed wire strand



NATIONAL EXPANDING ANCHOR (dirt set) end and corner posts



AMERICAN SINGLE-DRIVE GATE



INTER-TRACK STEEL PICKET FENCE

NEGLECT of proper fencing of yards, shops, buildings and right-of-way may result in costly damages and claims. Guard against this evil in 1936 by providing for adequate American and Cyclone Fence and fence accessories.

These fencing materials are built to meet all requirements of the specifications recommended by the American Railway Engineering Association. Products of the United States Steel Corporation, they are your guarantee of high quality, long life and low repair costs.

American Railroad Fence and Banner Steel Posts protect your right-of-way, and insure longer life and lower repair costs. Specify also National Expanding Anchor (Dirt Set) End and Corner Posts. These posts have ample strength for all fence requirements, and cost of installation is only a fraction of the expense of putting in other types of end, corner or stretching posts. American Steel Gates are made in styles for all types of fencing. For property protection, demand Cyclone Chain Link Fence. Cyclone Inter-track Steel Picket Fence for station grounds provides added safety.

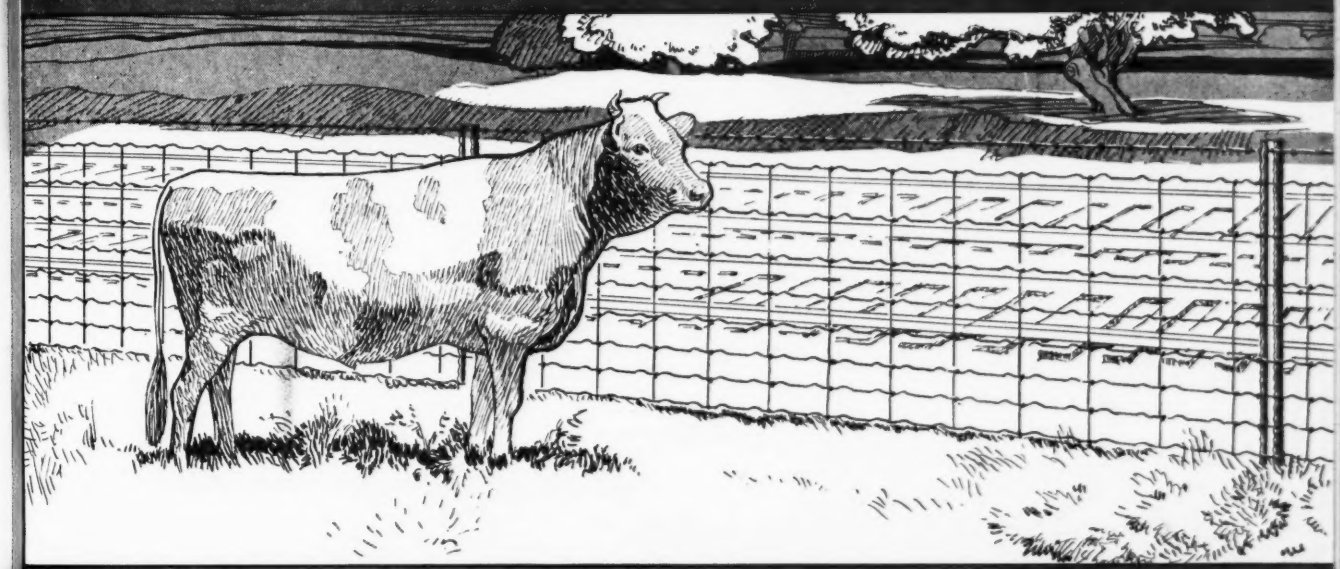
. . .

AMERICAN STEEL & WIRE COMPANY, CHICAGO
CYCLONE FENCE COMPANY, WAUKEGAN, ILLINOIS
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD CO., BIRMINGHAM
United States Steel Corporation Subsidiaries

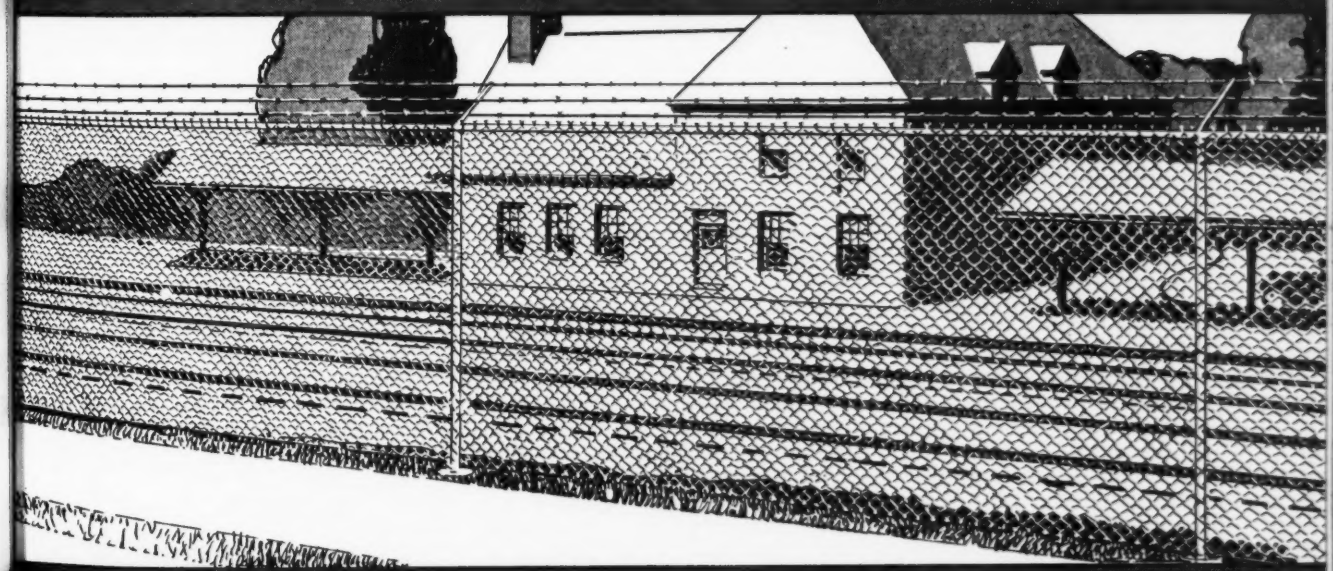
UNITED STATES STEEL

means just that when

YOUR RIGHT-OF-WAY . . . .



AND YOUR PROPERTY TOO . . .



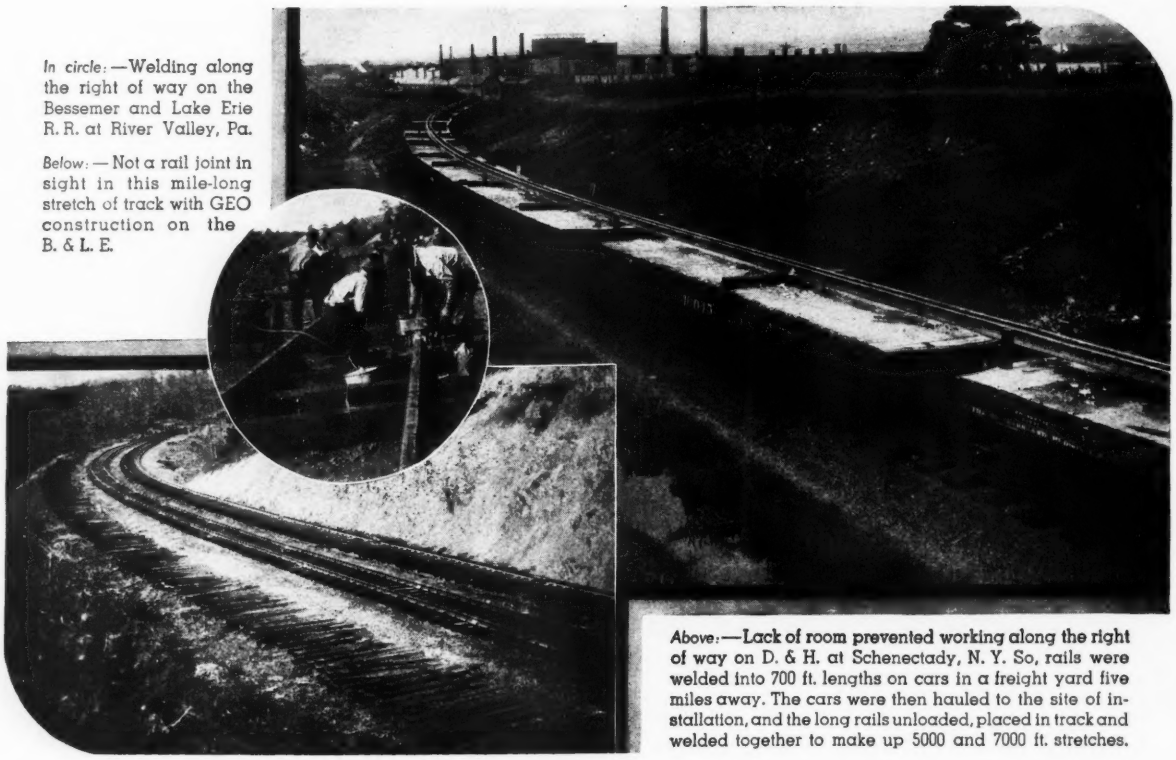
ARE PROTECTED BY

AMERICAN AND CYCLONE FENCE

Soon you'll think of RAIL LENGTHS IN TERMS OF MILES

In circle:—Welding along the right of way on the Bessemer and Lake Erie R. R. at River Valley, Pa.

Below:—Not a rail joint in sight in this mile-long stretch of track with GEO construction on the B. & L. E.



Above:—Lack of room prevented working along the right of way on D. & H. at Schenectady, N. Y. So, rails were welded into 700 ft. lengths on cars in a freight yard five miles away. The cars were then hauled to the site of installation, and the long rails unloaded, placed in track and welded together to make up 5000 and 7000 ft. stretches.

Not many years ago the advisability of increasing the standard length of rails from 33 to 39 ft. was a topic for considerable discussion. Now it seems safe to predict that rail lengths will soon be thought of in terms of miles instead of feet.

Continuous rails provide a long-sought solution to the track maintenance problem. Rails welded together into long stretches have no gaps for wheels to pound; no rail ends to batter. Joints are eliminated and joint maintenance is banished. Frequent track lining and surfacing become unnecessary. Rail life is increased; wear and tear on rolling stock and motive power reduced.

Nor, is there any doubt about continuous rails behaving satisfactorily under all sorts of conditions. A number of jointless stretches, varying from half a mile to one and a third miles in length, are now in service on main line track. Some are on straightaways, some on curves, some level and some on grades. Several installations have been giving good service for two and a half years. On the Delaware & Hudson, welded rails have been installed with M. & L. construction; on the Bessemer & Lake Erie, with GEO; and, on the Southern, with ordinary double-shoulder tie plates.

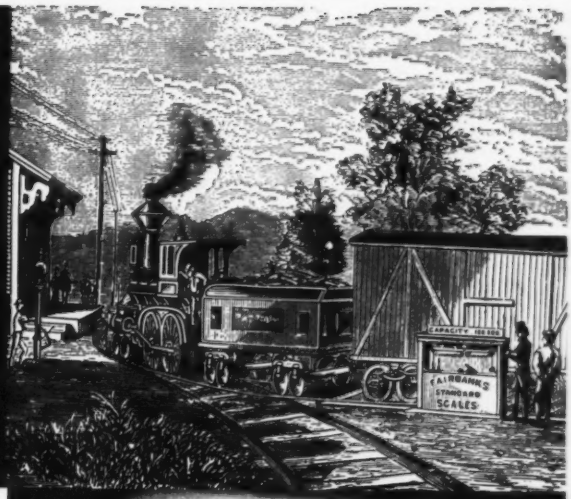
It will pay you to investigate. Write now for information, or, ask to have our nearest representative call and give you the complete story.

THERMIT Rail WELDING

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N. Y.

ALBANY · CHICAGO · PITTSBURGH · SO. SAN FRANCISCO · TORONTO

Since "WAY BACK WHEN"

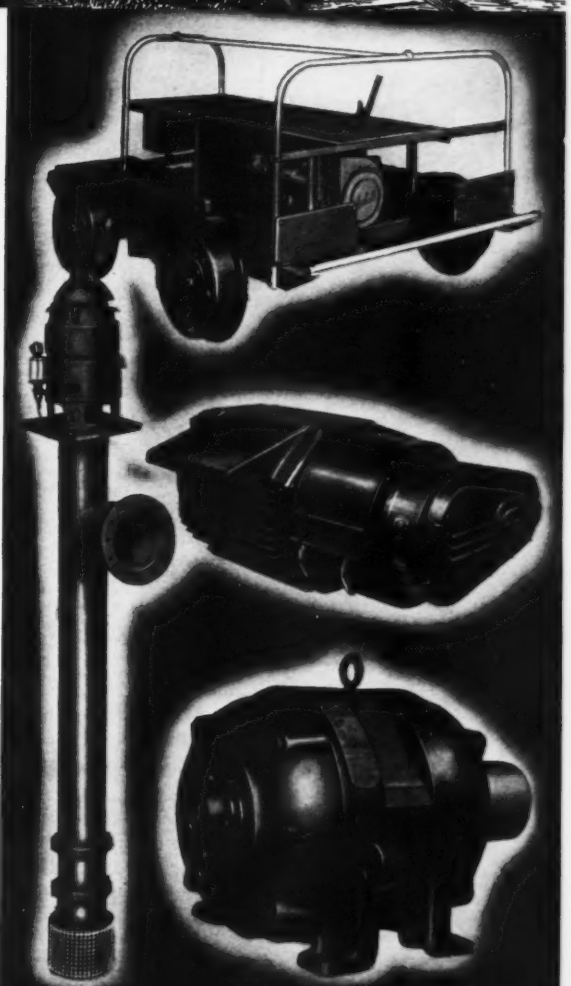


FAIRBANKS-MORSE HAS SERVED RAILROADING

BACK in the winter of '69, Thaddeus Fairbanks turned the first shovelful of dirt on the Portland and Ogdensburg railroad. That act not only began a railroad system that first connected Portland with Lake Erie . . . but it continued the long association that has kept Fairbanks-Morse closely in touch with railroading.

The products of this experience with practical railroading are known on every system—Sheffield motor cars . . . F-M motors and generators for air conditioning and general purposes . . . standpipes . . . coaling stations . . . turbine, centrifugal, power and steam pumps . . . track scales and many other F-M products especially designed for railroad service.

Drop in at the Fairbanks-Morse booths at the Coliseum from March 9th to 12th inclusive. We'll be glad to show you some of the new equipment you've been hearing about. Or, if you can't get to Chicago, address Department E731, Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.



106 YEARS OF PRECISION MANUFACTURING

FAIRBANKS-MORSE

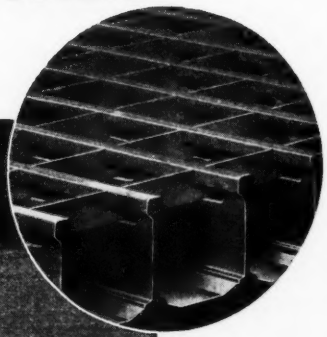
Railway Equipment

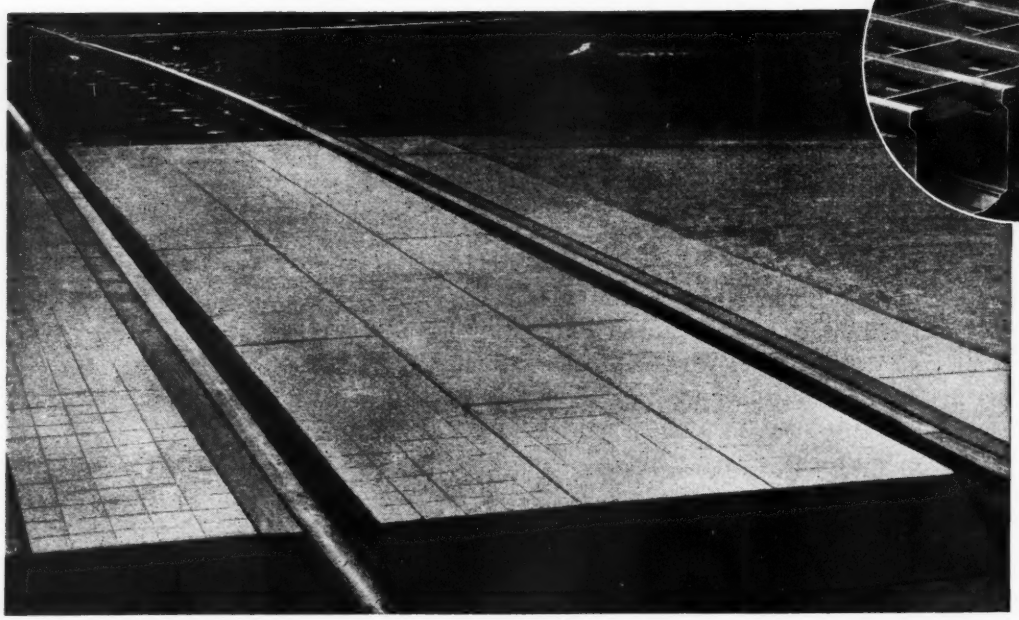
POWER, PUMPING & WEIGHING EQUIPMENT

6587GA21.1

Something new!

FOR SMOOTHER, MORE EFFICIENT GRADE CROSSINGS





(above) *Showing I-Beam-Lok construction. Units quickly removed, repairs made, and units replaced without loss or destruction of materials.*

(left) *This grade crossing illustrates an I-Beam-Lok type of construction. Provides smooth, efficient, anti-skid surface.*

A DEFINITE improvement in the construction of smoother, more efficient grade crossings—the new I-Beam-Lok grade crossing units!

Product of United States Steel, whose laboratories are constantly contributing to the progress of American railroading, these I-Beam-Lok units make possible a sturdier anti-skid surface that will give longer service with minimum maintenance.

I-Beam-Lok is available in standard units of 3 feet and 6 feet in length. They are prefabricated, ready for concreting. In case it is necessary to repair track or replace rails, these I-Beam-Lok units can be quickly removed, the repairs made, and the units replaced without loss or destruction of any materials. Investigate the many advantages of I-Beam-Lok . . . descriptive bulletin and complete data are yours for the asking.

CARNEGIE-ILLINOIS STEEL CORPORATION - *Pittsburgh-Chicago*

Pacific Coast Distributors: Columbia Steel Company · San Francisco
Export Distributors: United States Steel Products Company · New York

UNITED STATES STEEL

Facts About 24-in. Concrete Piles

Nearly three times load capacity of ordinary piles.

Only 40% as many piles needed.

Cost less per ton load capacity to make and drive.

No longer driving time per pile.

Driven between and outside stringer lines—*no stringer shifting!*

Three to five bents driven per 8-hour day.

FIREPROOF, HIGH-RESERVE-STRENGTH TRESTLES LIKE THIS... *at the cost of ordinary construction*

Every proper chargeable item of cost included, large-pile concrete trestles are being built for approximately $50 per foot.

Built under traffic, *first cost* may be lowest of any comparable type of construction.

Their *annual cost*—figuring in continuity-of-use value, insurance, maintenance and depreciation—is lowest on any line carrying enough traffic to pay to operate.

Portland Cement Association, Dept. A-2-27, 33 West Grand Avenue, Chicago, Ill.

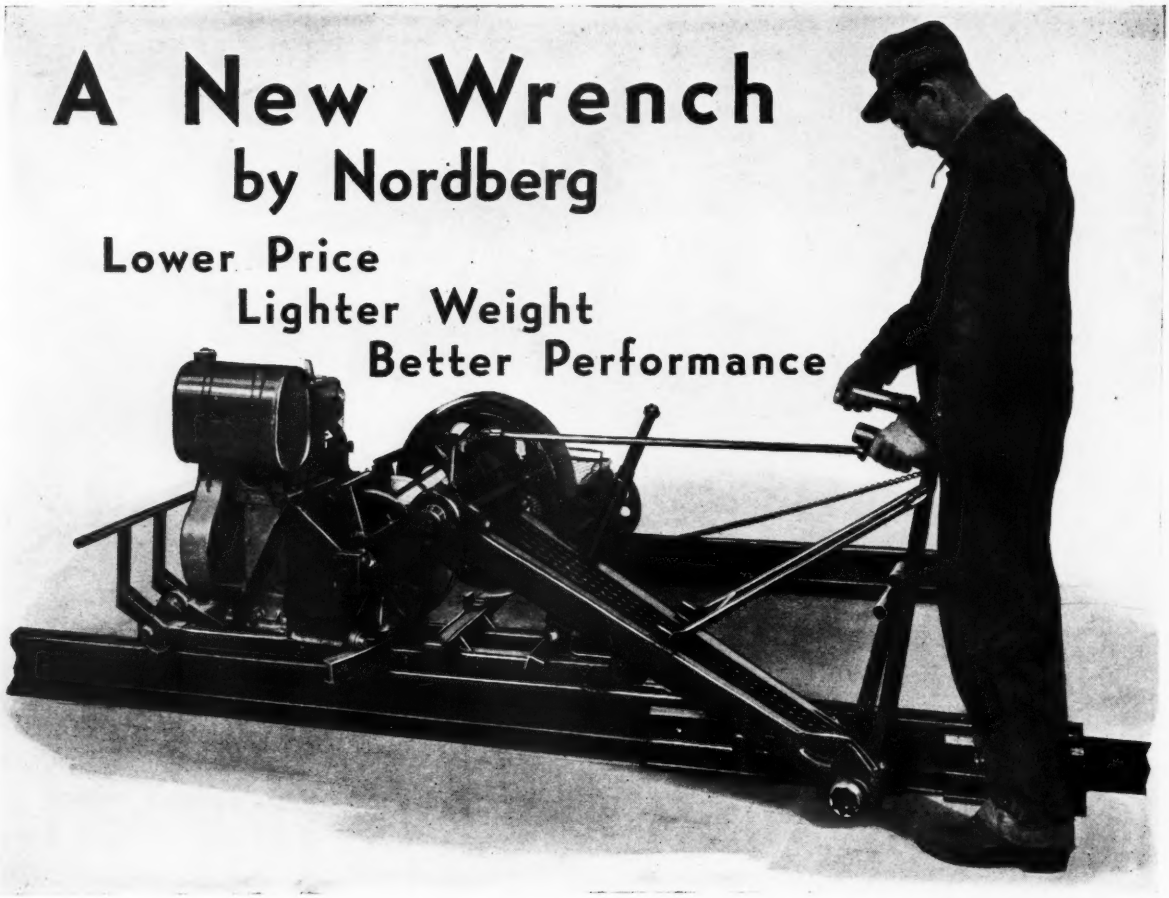
LARGE PILE CONCRETE TRESTLES

Step-by-Step Photos

Write for booklet "*Large Pile Concrete Trestles*"—38 views with fact-captions to match. Also send for Concrete Information Data Sheets (RB series) discussing design of large concrete piles; and design, manufacture, erection and cost of complete trestles.

A New Wrench by Nordberg

Lower Price
Lighter Weight
Better Performance



Note the comfortable position of the operator and the convenient controls which assure of higher production throughout the day.

With the new 8 horsepower engine, this is a better track wrench than has heretofore been offered to railroads. It is of extremely simple design, compact, light in weight, fast and powerful. It has everything required for heavy duty tightening. On regular maintenance work, it will start frozen nuts or twist off bolts if the nuts can not be loosened. When relaying rail, it will take off and put on nuts at a speed never before attained on maintenance work. All nuts are tightened uniformly. Can be quickly removed from rail and when placed in the intertrack space has ample train clearance.

These Other Track Tools Will Serve You Too!

Adzing Machine	Spike Puller
Power Jack	Rail Grinder
Utility Grinder	Rail Drill
Track Shifter	

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

TRACK MAINTENANCE MACHINERY

BARCO TYTAMPERS *Speed up* SPOT TAMPING

Equipment which helps spotting gangs do real work yet cover much territory must be light and compact for easy transportation. Maintenance superintendents are finding that this feature of Barco Unit Tytampers is a big asset.

The Barco Unit Tytamper needs no heavy or cumbersome equipment to be transported or set on the right of way, as each tamper is a complete self-contained unit. The entire unit can be moved from place to place by one man.

Because of their power and ease of handling, Barco Tytampers will drill ballast under the ties with sufficient force to bring rails and points up to the proper level. And it isn't necessary for the operator to bear down on the tamper—there is sufficient power even for cemented or tight ballast.

Standardize on Barco Unit Tytampers for efficient and economical tamping equipment.

BARCO

BARCO MANUFACTURING COMPANY
1805 W. Winnemac Ave., Chicago, Illinois

TYTAMPERS

The Holden Co., Ltd.
Montreal, Moncton
Toronto, Winnipeg,
Vancouver

No. 86 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: WHERE ORDERS ORIGINATE

January 30, 1936

Dear Reader:

"Where does an order for a maintenance of way material or device originate? In other words, to whom must I sell my product? Is the purchasing agent the key man for me to see or must I first convince maintenance officers and, if so, should I start with the chief engineer, the division engineer or the local supervisor. Whom must I see?"

This was the query I received a few days ago from a manufacturer who had achieved success in another field but who was now approaching the railway market for the first time.

"The answer is simple," I replied. "You must sell them all." Then I proceeded to explain to him how the experienced railway supply manufacturer first approaches the potential user of a device or material—commonly the man in charge of work out in the field—to interest him to the point where he starts a requisition, and I then traced this requisition through the offices of the division engineer and the engineer maintenance of way or the chief engineer to the purchasing agent where it is converted into an order. I showed him how each of these various officers must in turn be convinced of the merit of his product before the requisition can be advanced. It is in this possibly methodical and thorough manner that railway materials are adopted and once adopted, remain sold, with repeat orders the rule.

It is to inform and interest you--the men on the firing line, the users-- and to keep their products before you that leading manufacturers of maintenance of way materials and equipment advertise their products in Railway Engineering and Maintenance from month to month. These manufacturers know that you are the men who must initiate requisitions and they present the stories of their products to you. Are you reading their messages with sufficient thoroughness to insure that you are thoroughly conversant with all that they have to offer you? In other words, are you, as alert maintenance men, fully aware of the educational value of the advertising pages?

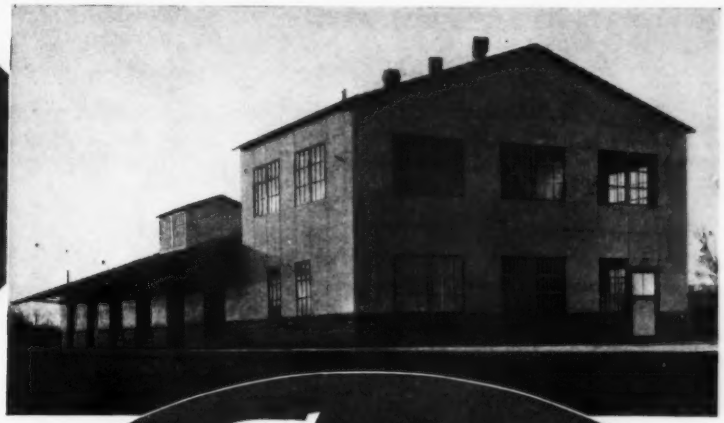
Yours sincerely,

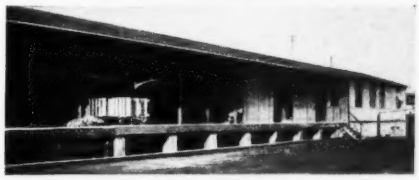
Elmer T. Howson

ETH:EW Editor.

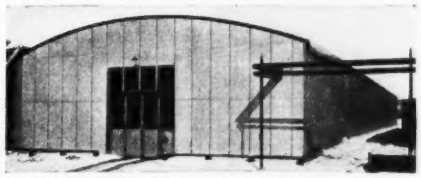
MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

NAME YOUR NEED





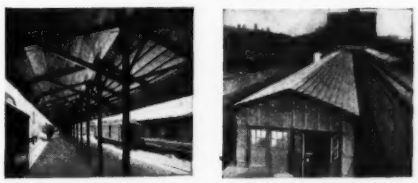
TRANSFER SHEDS



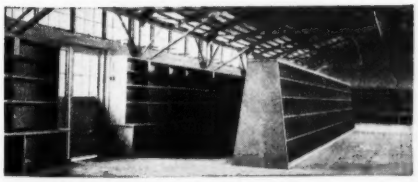
TOOL AND WAREHOUSES

SHOP BUILDINGS

BUNK HOUSES



PLATFORM CANOPIES



PARTS SHEDS

There's a

TRUSCON BUILDING

FOR EVERY RAILROAD PURPOSE

WIDE SELECTIVITY—You can select any type or size of building . . . any arrangement of doors and windows . . . any kind of side walls . . . flat, pitched or monitor roofs. Truscon meets your requirements exactly.

MINIMUM INVESTMENT—Fewer dollars erect a Truscon Building than are required to erect any comparable type of permanent, weather-tight, fire-resisting structure.

RAPID ERECTION—Irrespective of weather conditions, your workmen or ours can erect a Truscon Building in much less time than required for other types of buildings.

TRUSCON SERVICE—Preliminary studies of individual requirements, layouts, simplification of ideas, refinement of details and predetermination of costs are included in Truscon service. When preferred, Truscon's experienced organization will erect and complete your building ready for use with no trouble on your part.

PORTABILITY—Truscon Buildings can be dismantled and re-erected with practically 100% salvage value and with no impairment of the original advantages stated above.

TRUSCON TERMS—Convenient terms make it possible to spread payments over a period of time that is often sufficient to make a Truscon Building pay for itself from savings in maintenance costs and profits on the investment.

HOW TO GET ACTION—Communicate with the nearest Truscon branch office or write, telephone or telegraph to—

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO

Another Relining Job

THAT SAVED MONEY

Old stone arch under 20-foot fill on main line railroad in Kansas, being relined with Armco MULTI PLATE Arch. A small shelf or footing was first built inside the old arch.

MANY of the old arch culverts have served their purpose well, but are today in need of major repairs or replacement.

One of the simplest, yet most satisfactory ways of salvaging these drainage openings is to reline them with Armco Multi Plate. There need be but little reduction in waterway area.

These thick corrugated plates are quickly bolted together to form a strong, durable structure, either as an arch or a pipe.

Let an Armco drainage engineer discuss the application of Multi Plate to your particular problems. Just call or address the nearest office listed at right.

INGOT IRON RAILWAY PRODUCTS CO.
(Member of the Armco Culvert Mfrs. Assn.)
Middletown, Ohio • Berkeley, Calif.
Philadelphia • St. Louis • Salt Lake City • Los Angeles
Minneapolis • Houston • Portland • Atlanta • Denver
Chicago • Dallas • El Paso • Spokane • Cleveland
Pueblo • Sidney • Richmond

ARMCO MULTI PLATE For Economical Drainage

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

February, 1936

Editorials - 71

Safety—Ice on Platforms—Welding—Foundations—Snow Fighting

Large Scale Tunnel Relining Project - - - - - - - - - - - 74

Pennsylvania gives gunite treatment to 7,500-ft. brick lined tunnel in Baltimore—Developed special nine-car train to expedite work

Why Trains Run on Time - - - - - - - - - - - - - - - 79

G. M. O'Rourke describes the necessary preparations, organization of forces and equipment used in fighting snow storms

How Flexible Are Long Rails? - - - - - - - - - - - - - - 82

Rails butt welded in stretches of 20 on flat cars are readily moved over 10-deg. curves to point of laying

Track Awards - - - - - - - - - - - - - - - - - - - 85

Results of track inspections are announced by the Delaware & Hudson, the Chesapeake & Ohio, and the Pennsylvania

Self-Protection During Storms - - - - - - - - - - - - - 86

A. H. Peterson gives a detailed account of the precautions that must be taken to avoid casualties under severe conditions

How Good Is Timber Treatment? - - - - - - - - - - - - 88

Papers and reports presented at Wood-Preservers' convention review technical problems and demonstrate economy of treatment

Rough Track Derails Train - - - - - - - - - - - - - - - 90

Bureau of Safety ascribes accident to rocking of tank car induced by marked variations in cross level

What's the Answer - - - - - - - - - - - - - - - - - 91

New and Improved Devices - - - - - - - - - - - - - - 98

News of the Month - - - - - - - - - - - - - - - - - 99

Published on the last Thursday preceding the month of issue by the

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
932 National Press Bldg.

SAN FRANCISCO
55 New Montgomery Street

Samuel O. Dunn, *Chairman of the Board;* Henry Lee, *President;* Lucius B. Sherman, *Vice-President;* Cecil R. Mills, *Vice-President;* Roy V. Wright, *Vice-President* and *Secretary;* Frederick H. Thompson, *Vice-President;* Elmer T. Howson, *Vice-President;* F. C. Koch, *Vice-President;* John T. DeMott, *Treasurer.*

Subscription price in the United States and Possessions, and Canada, 1 year $2, 2 years $3; foreign countries, 1 year $3; 2 years $5. Single copies, 35 cents each.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.).

ELMER T. HOWSON
Editor

WALTER S. LACHER
Managing Editor

NEAL D. HOWARD
Eastern Editor

GEORGE E. BOYD
Associate Editor

M. H. DICK
Associate Editor

F. C. KOCH
Business Manager

RACOR

SELECTIVE PROCESS HEAT TREATED RAILS

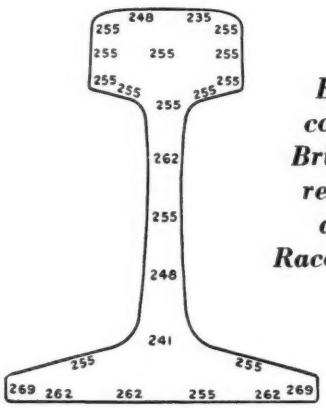
A New Process which provides—

① **Uniform increased hardness throughout the head.**

② **Ductility in the hardened head exceeding as-rolled rail.**

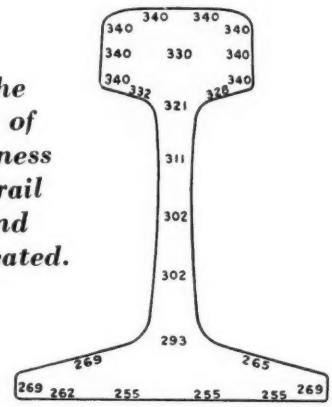
③ **Unhardened annealed base with increased ductility.**

No other process produces a Heat-treated Rail as well suited for use in railroad special trackwork, *i.e.*, switch points, frogs, crossings, etc.



As-Rolled

Examine the comparison of Brinell hardness readings of rail as rolled and Racor heat treated.



Racor Heat Treated

Hardened head increases resistance to abrasion and impact from wheel loads where needed, while the thin sections of the base are unhardened but annealed with greatly increased ductility —thereby better withstanding impact strain without danger of breakages.

Drop tests have proven our claim for increased ductility, the average increase in total elongation in 6″ being 50% with increased permanent set. Below is a comparison of average results from standard head-up drop tests, (2,000 lb. weight with 20 ft. drop in center of rails set on supports 4 ft. apart), on samples from the same rail, as rolled and after selective heat treatment:—

DROP TEST COMPARISON SHOWING **Average Results from Rail**	**As Rolled**	**Racor Heat Treated**
Number of blows	4.5	**6.0**
Permanent set	2.20″	**2.65″**
Elongation in 6″	.360″	**.590″**
Brinell hardness in head	260	**340**

Call on us for further information—Racor engineers will be pleased to consult with you, particularly on designs of special trackwork incorporating heat treated rail.

RAMAPO AJAX CORPORATION

HILLBURN, NEW YORK CHICAGO, ILL. EAST ST. LOUIS, ILL.
NIAGARA FALLS, N.Y. SUPERIOR, WIS. PUEBLO, COLORADO

RACOR PACIFIC FROG AND SWITCH COMPANY
LOS ANGELES, CALIF. SEATTLE, WASHINGTON

CANADIAN RAMAPO IRON WORKS, LIMITED
NIAGARA FALLS, ONT., CANADA

Sales Offices at the nine Racor Works listed above

General Offices: 230 PARK AVENUE, NEW YORK

Additional Sales Offices — WASHINGTON, D. C. — HOUSTON, TEXAS — HAVANA, CUBA
MEXICO CITY, MEX — BUENOS AIRES, ARGENTINE — SAN JUAN, P. R.

RACOR RACOR

Railway Engineering and Maintenance

Safety

Railways Stand Alone

WITHIN the last month the daily press has carried three articles dealing with safety of travel that are of direct interest to every alert railway employee. The first described the plunging of a bus through an open draw into a stream in Virginia, carrying all of its 14 passengers to their death. The second article recorded the loss of a passenger plane on January 14, which fell into a swamp in Eastern Arkansas, killing all of its 14 passengers and the 3 members of its crew. The third item recorded the fact that the railways of the United States operated throughout the entire year of 1935 without killing a single passenger in a train accident.

A Contrast

These three articles, all appearing in the newspapers within 30 days, are of more than incidental interest. They focus attention on the comparative hazards of travel by competing agencies of transportation. Both the bus and the plane cited above were in regular service, moving over their normal routes and piloted by their regular crews. For this reason, these accidents constitute a basis for comparison with railway travel that should be recognized by every railway employee and emphasized by him as a major claim on the patronage of the traveling public.

Nor are the accidents referred to unusual. So far as passenger-carrying planes are concerned, one need recall to mind only the untimely deaths of Knute Rockne and Senator Cutting in similar accidents to visualize the hazard that attaches to passenger travel by air, without regard to the still larger number of accidents occurring to planes in private flights, notable among which in recent months was that which befell Will Rogers and Wiley Post.

On the highways the record is still worse. Year after year the number of deaths has mounted until in 1935 the National Safety Council placed the number of deaths due to motor vehicle accidents in the United States at 36,400, a new high, although only slightly larger than the 36,101 deaths from the same cause in 1934. Spread over our entire populace, this is a death rate of 28.5 per 100,000 population. It means the killing of 100 persons every day of the year, Sundays and holidays included. Furthermore, motor vehicle deaths are increasing more rapidly than population, having risen 15 per cent in the last two years as compared with an increase of only 2 per cent in population. And none of these figures gives recognition to the staggering list of persons injured, this total approximating one million annually. This is the toll exacted of travel on the highways today.

Not all, or even a large proportion, of these casualties occur to persons traveling on public carrier buses. The number is small in proportion to the total. Taken by itself it is, however, a large group, with casualties among passengers running into the thousands. Accidents involving collisions between buses and other highway vehicles, involving buses running off the road, striking obstructions, etc., are of almost daily notice in the press.

The Railway Record

With the railways, the record is different. In spite of the hazard inherent in its operation, the largest number of persons ever killed in a year was in 1907 when the fatalities, including 5,612 trespassers, totaled 11,839 and the number injured aggregated 111,016. And in 1934, the latest year for which complete figures were available, the total number of persons killed in railway accidents of all kinds was only 4,879, (of which 2,654 were trespassers) and the number injured was but 28,631. Among these accidents were 3,728 at grade crossings for which the railways were, at the most, but partially responsible, but which resulted in 1,554 of the fatalities and 4,300 of the injuries.

Furthermore, it is worthy of mention that at the very time when highway accidents are increasing so rapidly, the railways are achieving new records for safety, not only to their patrons and to their employees, but also at highway grade crossings as well—the only class of accidents in which highway travel is involved which shows a tendency to decline. And they carried hundreds of millions of passengers throughout all of last year without killing a single one in a train accident.

Safety a Primary Consideration

Safety of travel is one of the primary considerations of the passenger. Except in an emergency, the average person will not knowingly incur risk, but will select that agency which, other considerations being equal, is least hazardous. In their competition for public favor, the railways offer numerous advantages, including superior dependability, comfort and safety. These advantages should be brought to the attention of travelers again and again in order that they may fully appreciate them and give

them recognition in the selection of their transportation agency.

To a railway employee, it may appear unbelievable that others know little about the railways, and the service they render. Yet there are many today who have become so accustomed to other agencies of travel, especially the automobile, that they have little real knowledge of the advantages of railway service and especially of the improvements of the last few years.

The American public is becoming more and more travel minded. The average person is traveling more today than in any previous time. Yet during the period when this development has been taking place, railway passenger traffic has been declining. Thus, not only has the highway vehicle developed a large volume of traffic of its own, but it has also attracted much from the railways.

This is a tendency that menaces the security of position of every railway employee. It has already deprived many men of their livelihood. For his own personal interest, therefore, every railway employee should familiarize himself with the advantages of the service rendered by the railways and then give these advantages the widest possible publicity. Outstanding among these advantages is safety of travel. No other agency approaches the record made by the railways in the protection of their passengers. This should be emphasized at every opportunity as a means of bringing back to the railways the business that their outstanding record of performance warrants. No influence is as effective, in this direction, as the active interest of employees, each among his own circle of acquaintances.

Ice on Platforms

Salt Can Sometimes Be Used to Advantage

THE recent unexpected and widespread cold wave created conditions in more than one case which required the immediate attention of maintenance forces. One of these was ice on station and other platforms. In some sections mild temperatures had preceded a light fall of snow which melted or melted partially as it fell, in both cases leaving a film of moisture or of slush on the platform surface. This was followed by a quick and severe drop in temperature which left platforms covered with ice which could not be cleared by ordinary means.

This brought to the fore the question of using salt to remove the ice. Some railway officers forbid its use for this purpose, but permit sand or ashes to be sprinkled over icy surfaces to prevent slipping. One disadvantage of this latter practice is that both materials lose their effectiveness if there is a further accumulation of ice or snow. Another is the ease with which the ashes are tracked into cars and buildings. The latter objection has also been raised against the use of salt.

In part, objection to the use of salt for cleaning station platforms has arisen from lack of understanding of how to use it. Ordinarily, a heavy application of rock salt of the size used around switches is made by scattering it from shovels or by hand, no effort being made to spread it uniformly. The proper method is to use the smallest sizes available, pulverizing the coarser grades if the other is not available, and applying it lightly and uniformly after all loose snow has been removed. Where a heavy application is made, it is practically impossible to get rid of the salt residue until it has been washed away by later rains.

Among the advantages of using salt are its low cost and the quickness with which results can be obtained. Reliance should not be placed entirely on the salt to remove the ice, however. Enough men should be on hand to clean the platform as soon as the ice has been loosened; otherwise, the platform will be left with a whitened and streaky surface, which is very unsightly, as the moisture dries out. Used as suggested, an application of salt saves both time and effort of the maintenance forces, and restores the platform to a safe condition in minimum time.

Welding

A Note of Caution in Work on Bridges

RELUCTANCE to adopt fusion welding in bridge work was based, in the early stages of this development, on the uncertainty as to its reliability—many bridge engineers questioned the strength of the connections made. However, this objection has been largely overcome with the accumulation of experience and the establishment of a technic in both design and workmanship. As a result, welding has become established as a useful means of repairing and strengthening old bridges, although its application to the fabrication and erection of new structures is still in the experimental stage.

Until recently, however, one question regarding the effect of welding has remained largely unanswered—namely, the effect on the distribution of stresses that results from the heating of the parent metal during the application of the weld metal. Suppose, for example, that a steel viaduct column is being reinforced by the welding of bars or narrow plates to its sides. This results in the heating of the column along several narrow strips while the rest of the metal remains cold, so that the tendency of the hot metal to expand is resisted by the cold metal. Later, when the hot metal cools, its tendency to contract is resisted for the same reason, and internal stresses are set up, with the result that, in general, the portions of the column that remained cold throughout the welding operation are subjected to higher compressive stresses than the portions that were heated.

This question was raised in connection with the strengthening of a high steel viaduct on the Nickel Plate, with the result that arrangements were made with the Materials Research Laboratory of the University of Illinois, to investigate the stresses set up in the columns of this viaduct. And after this study disclosed some rather disconcerting variations in stress, the investigation was extended to include the testing of some columns of the same type furnished by the American Bridge Company and the McClintic-Marshall Company. This investigation disclosed that, although the metal in the columns was subjected to considerable variation in stress, the columns that had been reinforced by welding plates to them were stronger than the unrein-

forced columns to an extent substantially proportional to the increase in sectional area provided.

While this investigation was rather limited in its scope the results obtained should go a long way to allay concern regarding this particular phase of welding as applied to steel bridge repairs. However, the officers in charge of field welding must keep this point constantly in mind with a view to avoiding these thermal effects in so far as it is possible to do so. Good practice in this regard implies the alternating of the operation on different parts of the members, rather than in concentrating the work on a limited area. There are, of course, circumstances where this is not possible, but it is well to impress on the welder that he should avoid excessive heating of the parent metal in a member being welded.

Foundations

What Do You Know About Them?

NO phase of the duties of the officer in charge of bridge maintenance weighs more heavily on his shoulders than his responsibility for the security of bridge piers. The condition of all other parts of a bridge can be ascertained at a nominal outlay for inspection, but the condition of a pier foundation or of the portion of the shaft below water level can be determined only through measures that will cost considerable money.

In some cases, the need for such an examination can be justified by directing attention to the limited depth of penetration of the pier footings or foundation piles below the bed of the stream, or to such other unsatisfactory features of the foundations as may be indicated on existing plans or construction records. However, in some instances the only justification that can be offered for the expense involved is the fact that there are no facts and that, therefore, something *might* be wrong.

The condition of pier shafts, and in some cases even of timber grillages may be examined by a diver. Exceptional opportunities for such inspections or even of examination in the dry were afforded two or more years ago, when the succession of severe drouths lowered the water surface in many streams almost to the vanishing point. But such examinations are precluded in not a few instances by the presence of large masses of rip rap, which leave no choice but to enclose the pier in a cofferdam so that the protecting cone of stone may be removed.

Such a procedure is an exceedingly expensive one, but the very fact that it has been deemed necessary to provide the rip rap protection indicates that there is some uncertainty concerning the security of the foundation. Obviously, the most favorable time for undertaking such a task is the period when the lowest stage of water may be expected, and not infrequently lower water stages with less likelihood of a sudden rise occur during the winter months. Offsetting this advantage are the added expense of cutting ice, the time lost during stormy days or periods of extreme low temperatures, and the reduced efficiency of the men. However, regardless of the difficulties and the expense, the bridge man owes it to his management as well as to himself to urge the institution of whatever measures are necessary to insure safety.

Snow Fighting

A Development of the Depression Period

THERE is a distinct parallel between the history of labor saving appliances used in fighting snowstorms and the story of how power equipment came into use in the various operations incident to the construction and maintenance of railways. Early efforts to supplant manual labor with mechanical appliances in fighting snow were centered on the improvement of the primitive snow plow, leading to the invention of the rotary plow during the "eighties" of the last century. This development was concurrent with the perfection of the steam shovel and was prompted by the same basic consideration—the substitution of machines for men in the movement of large volumes of material.

In other words, mechanical appliances were introduced first for the performance of tasks in which manual labor is much slower and many times more expensive; and for more than a quarter of a century progress in the mechanization of maintenance of way work was confined almost entirely to the improvement of machines of this general classification. Operations in which the savings to be effected were obviously less pronounced did not then seem to offer as fertile a field for mechanical appliances.

It was not, therefore, until after the introduction and successful application of such devices as the mechanical tie tamper that attention was directed toward means of replacing hand labor in keeping switches clear of snow. As a matter of fact, most of the development in this field has taken place since the advent of the depression.

While a desire to reduce the cost of keeping tracks in condition to handle traffic was, no doubt, a contributing factor, the real incentive was the demonstrated fact that effective snow melting devices would keep switches, car retarders and interlocking plants clear under conditions that could not be combated successfully in any other way. In addition, their use obviates the confusion and hazards incident to the employment of large numbers of inept casual laborers.

Snow melting equipment has its limitations, as was demonstrated in the Chicago terminal area during the last month, when a period of unusually low temperatures, attended by high winds, proved too much for certain types of heaters. But it is under just such conditions that manual labor is most inefficient, and it is doubtful if the effectiveness of the snow melters was reduced in any greater proportion than that of men engaged in any sort of task while confronted with the necessity of protecting themselves from freezing and the hazards presented in work on railway tracks at such times.

Owing to the variations in the conditions imposed by storms occurring at different times, it is impossible to draw any accurate comparisons, but it is certain that any officer who has had to cope with winter conditions over any period of years is convinced that the introduction of snow melting appliances have been of extraordinary value in coping with snowstorms.

Night Operation of the Nine-Car, Four-Gunite-Crew Relining Train

Confronted with the immediate necessity of drying up and repairing the lining of its old 7500-ft. brick-lined tunnel at Baltimore, Md., to eliminate the formation of icicles during the winter and permit electric train operation, the Pennsylvania developed a nine-car, self-contained gunite train to carry out the work in a most expeditious manner, without interfering with traffic. Details of this train, the methods employed in the lining work, and the unique problems encountered in maintaining the equipment to full efficiency under the existing conditions encountered, are described in this article.

Large Scale O
Speed Tunnel Re

IN preparation for the electric operation of its trains between Wilmington, Del., and Washington, D. C., the Pennsylvania has made extensive repairs to the lining in its three-secton 7500-ft. double-track tunnel just south of its main passenger station at Baltimore, Md. This work, which involved essentially the guniting of the old brick arch lining, is of special interest not so much because of the specific method employed, which is not new, but because of the scope of the work, the unusual difficulties encountered, and the unusually complete and effective nine-car equipment train built to carry out the work expeditiously and without interfering with traffic.

The primary reason for the work was the wet condition of the lining, with dripping at many points, which resulted in the formation of icicles during the winter which would interfere with pantograph operation. The particular difficulties encountered in the work were largely in connection with the equipping of the nine-car guniting train employed, to permit operation of the equipment, especially the engines, compressors and generators, under the dirty material-laden air conditions incident to the work. When these difficulties were overcome, and when an adequate organization had been set up to service and maintain the equipment under the unusually severe demands made upon it, the lining work, with four guniting crews in operation, progressed at a rapid rate.

Tunnel Leaked Badly

The Pennsylvania has three tunnels at Baltimore, two north of its station, including a new 3,400-ft. double-track bore completed last fall, and the old tunnel south of the station. It is this latter tunnel, which was constructed in 1872, which was the scene of the lining work to be described in this article. This old tunnel, which, as a whole, is known as the Baltimore and Potomac tunnel, is divided into three sections by short gaps, as the result of which different names have been given to each section. The north section, which is approximately 1150 ft. long, is known as the John Street tunnel; the center section, which is approximately 3,650 ft. long, is known as the Wilson Street tunnel; and the southerly section, called the Gilmor Street tunnel, is approximately 2,200 ft. long. The largest gap between sections, approximately 300 ft., is between the Wilson and Gilmor Street tunnels. The tunnel has three curves in it and is on a grade ascending to the south, varying from 0.87 to 1.39 per cent.

In general, the construction throughout the tunnel is the same, consisting of a five-ring brick arch above stone and concrete masonry bench walls which extend to a height of approximately 6½ ft. above the top of rail. Cut through varying strata of clay and gravel, and, at one point passing beneath the bed of an old stream, water has always been a problem in the tunnel. Weep holes provided originally in the bench walls near the track level had unquestionably been effective at one time in draining off water which penetrated through to the tunnel lining, but they had become fouled, and, in spite of such cleaning as could be done, were largely ineffective. This was clearly evident in the fact that almost all of the tunnel lining was wet continually, and at many points, especially in the Wilson Street tunnel, it leaked over a large part of the track area.

During the winter, this leakage permitted the formation of icicles over much of the arch, which had to be broken down repeatedly by forces employed in the tunnel in order not to interfere with train operation. With the plan for electric operation through the tunnel, employing catenary and a pantograph contact system, it was

Preparing the Surface by Sand Blasting Before Applying the Gunite

Operations Relining Project

obvious that the icicle problem would have to be solved. Further, the lining leakage itself, and the general condition of the lining at many points, had become sufficiently bad to warrant a thorough waterproofing and repair job.

On a considerable up-grade to the south, which required the double-heading of many trains and the frequent use of pusher locomotives, the most severe lining wear as the result of locomotive blast was directly over the southbound track. As a matter of fact, while that part of the lining over the northbound track was in fairly good condition, that over the southbound track was the subject of constant attention to repair sections of the inner course of the lining worn away or broken down by the stack blast action.

Coping with this situation required almost constant maintenance work on the lining, and quite heavy repair work for a period of from two to three months each year. In this heavier work, considerable patching with gunite had been done since about 1923, a special scaffold car being used to carry it out. This remedied the worst conditions as they developed, but was recognized as inadequate in scope to remedy the generally unsatisfactory conditions for electric operation.

In general, the tunnel is semi-circular in section above the spring lines, with an average crown height of approximately 22 ft. above the top of rail, and a width of 27 ft. between vertical side walls. These limiting dimensions made it necessary to maintain track centers of 12½ ft. generally throughout the tunnel. This distance was considered adequate for electric operation, but it was recognized that any reduction in side and overhead clearances as the result of any lining repair work would have to be a minimum.

Apply Gunite

The method employed in relining the tunnel was essentially the gunite method, in which three layers of gunite concrete were shot continuously over the arch, following thorough cleaning of the old brick lining and the stopping of the worst leaks by the use of rapid-setting cement plaster. Because of the extent of the work and the limited time before electric operation was to become effective, the new lining was extended over only that part of the arch between points approximately six feet above the spring line on each side. This carried the lining well beyond the side limits of pantograph operation. Later, the lower sides of the arch can be lined just as effectively as though carried out with the initial work.

In relining the tunnel, the first operation consisted of cleaning the old lining with either a sand blast or high pressure water. Immediately behind the cleaning operations, the first coat of gunite was applied, this coat being forced well into the brick joints. The second and third coats were then applied, in order, but, in each case, not until at least 24 hours after the preceding coat, and then only after the preceding coat had been thoroughly washed down to remove any soot or dirt. Where the amount of drip was such that the gunite could not be made to take hold, these places were closed by hand plastering with a Sika, quick setting, mixture.

Simultaneous with the lining work, a new line of weep holes was drilled along each side of the arch, approximately 14 ft. above the top of rail, or 6 ft. above the spring lines. These holes were provided with 6-in. lengths of 2-in. pipe, spaced from 30 in. to 12 ft. apart, depending upon the water conditions found, and the pipe in each case was allowed to protrude about 2 in. inside the lining face to permit any drip to fall clear of the side walls.

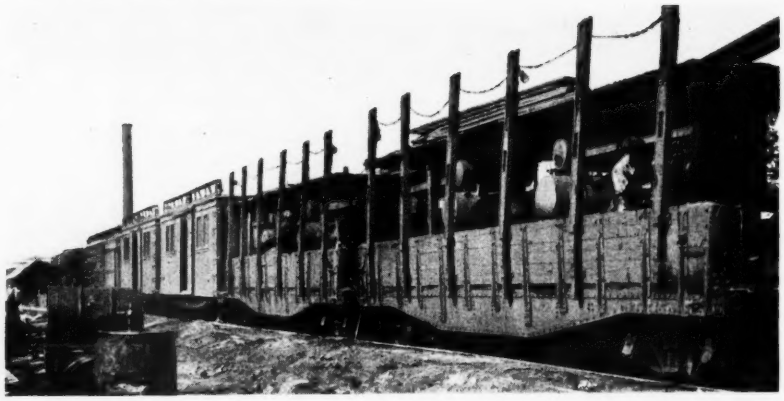
Nine-Car Train Used

The first of the lining work, which was done in Wilson tunnel because of the bad condition prevailing there, was started with a single scaffold car and one gunite machine. Shortly, however, a complete self-contained nine-car train, with four gunite machines and all auxiliary equipment, was put in service.

The purpose of this extensive equipment was primarily to permit rapid prosecution of the work with the greatest economy, while at the same time making it possible to free the tunnel of all equipment and other obstructions during those hours of the day when double-track train operation was necessary. Incidentally, however, the car-mounting of the complete lining equipment was highly desirable because of the length of the tunnel, which would have necessitated long pipe lines, with almost prohibitive drops in pressure, if the air compressors and water supply necessary to the operations had had to be located at the portals.

The gunite train, which was moved by a steam locomotive, included, in

Four Crews, Sand Blasting and Guniting, Keep the Work Progressing at a Rapid Rate



On the Storage Track, Where the Train and its Equipment Is Serviced and Cleaned

order, the following cars: An old coach, equipped with a riding compartment for the men, a tool room, a store room and a small office for the foreman; a box car, called the plasterer's car, which housed such supplies as the liquid waterproofing, hose, weep hole pipes, wire reinforcing mesh, etc.; a second box car, designated a gunite car, which will be referred to in detail later; two gondola scaffold cars, carrying the main air compressors of the equipment; a second gunite car; a fourth box car housing the main electric generating equipment; and two additional gondola scaffold cars, designated driller's cars, which were employed by the crew drilling the new weep holes. All of those cars were provided with working decks on top, with side railings, so that the lining repair work could be carried on over the full length of the train.

Housed in Four Cars

Practically all of the major equipment involved in the lining work was housed in four of the cars. Each of the gunite cars, as shown in the accompanying deck plan, housed two gunite machines located near the center of the car, with an elevated material trough between them. Immediately along one side of this trough, at the floor level, was a mixing bin, in which the sand and cement batches were prepared. As prepared, they were shoveled directly into the high trough between the machines, from which the material was pulled by hoes, one way or the other, directly into the hoppers of the machines.

The sand supply, which was bagged in quantities of approximately one cubic foot, was located in one corner of the car, while the cement storage was in the corner directly opposite. The water necessary to the guniting operations and for washing down the old tunnel lining was stored in the opposite end of the car in two 500-gal. horizontal steel tanks and two 300-gal. vertical steel tanks, all of which were provided with air-line connections to permit building up the desired working pressures. The air supply for the operation of the gunite machines and for building up the washing water pressure was stored in a steel tank reservoir, 24 in. in diameter and 8 ft. high, which was located near the center of the car on the side opposite the material mixing bin. With the different units thus arranged, there was minimum handling of materials, ample working space, and an unobstructed aisle for passage through the car.

Four 330-cu. ft. Worthington air compressors furnished the necessary air for the washing, sand blasting and guniting operations, these being located, two to the car, on the two scaffold cars coupled between the gunite cars. The two compressors on each car were synchronized in their operation, and, through a common supply line, fed the air reservoir in the adjacent gunite car. Thus, each gunite car had its own air supply, independent of the other, although, for convenience in carrying out the work and in operating and maintaining the compressors, the four compressors were located together.

Between the compressors on each car there was an 850-watt, 32-volt, d.c. Delco gas-engine generator, suitably housed and connected with storage batteries for emergency lighting of the train. Another such generator was located in one of the driller's cars and was used to supply lighting current to these cars when they were detached from the rest of the train in carrying out advance operations.

The main lighting generator, located in the generator car, was a Syntron 15-kw., 3-phase, 25-cycle, 110-volt tie tamper generator. This unit, under ordinary circumstances, supplied all of the current for the lighting of the interior of the train and the working operations on the top deck, and also for providing illumination along both sides. A part of the car carrying this unit was also used for sand storage and for the storage of carbide water lights, used in emergency and where special illumination was required.

The only equipment on the two driller's cars included the Delco gas-engine-generator lighting unit mentioned earlier, and a 220-cu. ft. Worthington air compressor, used for supplying air to the drills employed by the weep-hole crews. A small housed-in compartment was provided on one of these cars to shelter the drillers from the blasts and gases of passing trains.

Some Interesting Features

Some of the most interesting features of the tunnel lining work were the difficulties encountered in the early operation of the engines and compressors under the foul air conditions which prevailed during the work, and the means which were employed in overcoming these difficulties. These will be discussed later.

Because of the heavy traffic through the tunnel during the day, the relining work was carried out at night, usually between 9:30 p.m. and 4:30 a.m., when full use of one track could usually be secured. From the standpoint of progress of the work, this offered no particular handicap, since the daylight hours of each day were required for cleaning and servicing the train, and for otherwise making it

and its equipment ready for the night operations.

The force employed on the train was divided principally into lower deck crews, which operated the gunite machines and power equipment; four gunite crews above deck, which carried out the washing, sand blasting and guniting operations; and two drilling crews, which provided the new weep holes. The drilling operation, which was the advance operation in the work, consisted essentially of drilling 2½-in. holes through the brick lining at the proper height and spacing, and then placing the short weep-hole pipes. This work was carried out with two I-R air drills with star drill points, which cut through the lining and backing material for a distance of at least 24 in. The six-inch pipe sections were then set in place and were grouted in with waterproofing cement plaster to afford a quick tight bond. The short pipe inserts were used so that they will not only carry off any water from above and back of the old five-ring arch, but so that they will also intercept any seepage which may exist between the various rings in the arch.

Special Air Supply

Under normal conditions, the work of the weep-hole crew was carried out immediately in advance of the other operations, and, for this reason, the drill cars were at times cut off from the rest of the train and spotted ahead. Air for the operation of the drills was supplied by the 220-cu. ft. compressor on the deck of one of the drill cars, and illumination, as before mentioned, was afforded by the Delco generator unit on the other drill car.

The remainder of the train was kept intact at all times and was used in the cleaning and guniting operations. Where the old lining was coated with only a light moist film of soot, which was the condition quite generally over the north-bound track, a hose stream at from 90 to 110-lb. pressure was found adequate for cleaning purposes. While working in the John Street tunnel, the washing water supply was piped into the tunnel from a 100-lb. pressure city fire line near the north portal, but beyond a certain distance from the portal, the pressure drop in the line made this source of supply inadvisable. Therefore, throughout the Gilmor Street tunnel, and in most of Wilson Street tunnel, the washing water supply was taken from the storage tanks in the gunite cars, where a pressure of at least 90 lb. could be maintained.

Where washing was not sufficient to clean the old lining, the soot was first scraped off with shovels and the surface was then sand blasted. This was done with nozzles supplied from the gunite machines.

Procedure

Proceeding in accordance with a definite schedule, the efforts of the entire crew were arranged to keep the cleaning and guniting work moving along simultaneously. Thus, of the four upper deck crews, it was not uncommon to find two of the crews sand blasting and washing immediately ahead of guniting operations, the four crews always being well spread out over the length of the train. At other times, because of the longer time required in much of the cleaning work, all four crews were concentrated on washing and sand blasting, while at still other times, especially when applying the second and third coats of gunite, all four crews were engaged in guniting operations.

No reinforcing mesh was used in the gunite lining, except where the depth of erosion called for a thickness of gunite which required some reinforcing, the first coat being shot directly on to the cleaned brick, care being taken to force it well into the old mortar joints. The only precaution taken prior to the guniting, other than careful cleaning, was to patch spots where there is any considerable drip. In this, waterproofing plaster, that is, cement and sand with waterproofing liquid admixture, was used. This plaster, mixed in small batches because of its rapid hardening qualities, was applied over the leaking area of the lining. The first coat was forced into the joints by hand, while the subsequent coats were applied with a trowel.

The first gunite coat was put on to a thickness of approximately ¼ in., while the two subsequent coats were each from ¼ in. to ⅜ in. thick, resulting in a final thickness of approximately ¾ in. A one-three mix was used throughout in the gunite concrete, the only difference in the material in the three coats being that while a coarse sand was used in the first two coats, a somewhat finer sand was used in the last coat to produce a denser and smoother surface. At least one night was allowed between the coat applications.

Rate of Progress

While operating four nozzles, as much as 12,000 sq. ft. of single coat was applied in a night, although the average area covered was approximately 9,000 sq. ft. a night. The cleaning operations, and especially the sand blasting, took considerably longer than the guniting, so that the complete lining with three coats progressed at

A Drill Crew at Work Installing the New Weep Holes

Inside One of the Gunite Cars

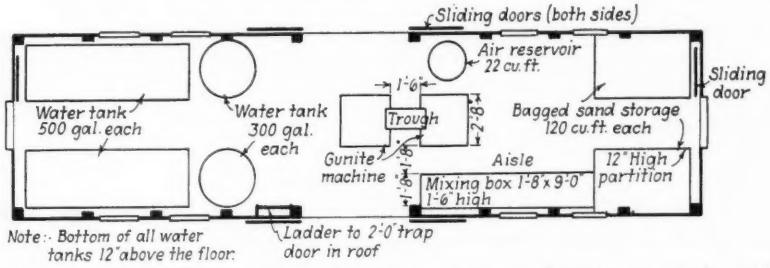
an average rate of only about 1,200 sq. ft. a night.

The force on the train involved in the night operations included approximately 29 men and a foreman, as follows:

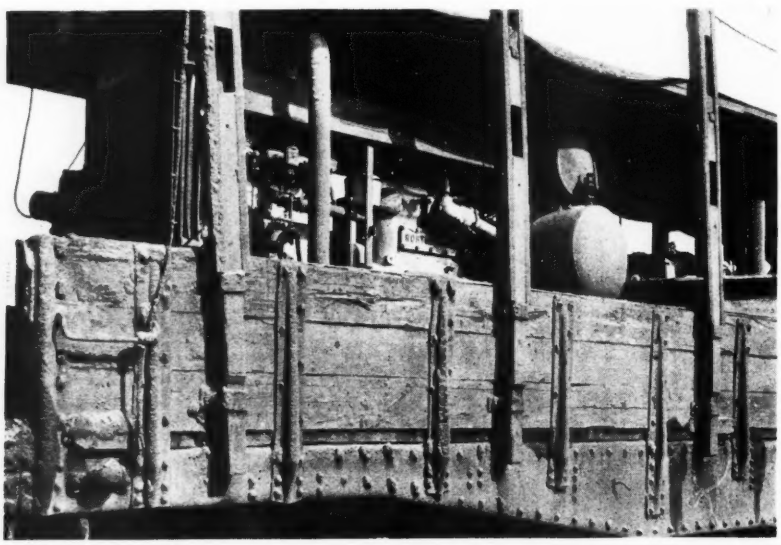
1 foreman
1 work-equipment repairman
2 Gunite Cars—
4 carpenters—nozzlemen
4 carpenter helpers, assisting nozzlemen
4 carpenters—operating guns in cars
6 carpenter helpers—mixing materials
2 Drill Cars—
2 carpenters—drillmen
2 carpenter helpers, assisting
Plastering Gang—
2 masons
1 mason helper
1 carpenter helper
2 laborers

Making the gunite train self-contained, to avoid the difficulty involved in long pipe lines and to insure the greatest efficiency in operations, was obviously the most desirable arrangement for carrying out the work, but it was not accomplished without many early difficulties in providing for satisfactory operation of the various units of power equipment. With the air of the tunnel about the equipment laden with dust and sand during the sand-blast operations and fine particles of cement during the guniting operations, the fuel, lubricating and cooling systems of the engines and compressors in the earliest work became fouled in only a few hours' time. Carburetors became clogged as fouling of the fuel and lubricating systems, and to clean the air introduced into the equipment, Air-Maze air filters of large cleaning capacity were provided on all air intakes of both the engines and compressors. To afford additional radiation for these machines, auxiliary radiators with blower-type fans were connected in series with the normal radiators provided. The objectionable overhead exhaust of the engines was remedied by providing a 180-deg. bend at the top of each exhaust pipe, and extending the pipe down through the car floor. This deposited the heavier poisonous exhaust gases at the track level where they had a normal tendency to remain.

While these remedies made possible effective operation of the equipment within the tunnel, it was essential that they be accompanied by the most careful and constant maintenance of the equipment. The extent of this maintenance, and the severity of the conditions under which the equipment was operated, are seen in the maintenance schedule of the day force which, each day, prepared the gunite train for the following night's operation. Some of the more important items on this schedule are included in the following:



Floor Plan of the Gunite Cars, Showing the Arrangement of Equipment, Tanks, and Storage Bins



One of the Four 380-Cu. Ft. Air Compressors on the Train—Note the Auxiliary Cooling Blower to the Left of the Radiator; and the Downward Exhaust Pipe from the Engine

Daily

Clean off all equipment with high pressure air
Grease and oil air compressors and large lighting generator
Clean sediment bulbs of engines
Clean and change oil in air filters
Drain and refill all radiators
Blow out and clean gunite machines
Look for leaks in air lines

Weekly

Drain and change oil in compressors and engines
Clean oil filters of gas engines
Clean carbureters
Clean magnetos
Bend down and clean out gunite machines
Inspect governors
Check and refill storage batteries
Grease and clean air drills

Monthly

Clean cooling systems
Drain and clean out gasoline tanks
Clean and grease air motors of gunite machines

Train Restocked Daily

To these items were added numerous other smaller items of inspection, maintenance and repair which had to be given attention regularly, in addition to the no small amount of work which had to be done daily in cleaning and restocking the cars for operation during the following night. Depending somewhat upon the particular operations carried out in the tunnel, the top decks of the cars became covered with soot, sand and cement daily to a depth of from one to three inches, and, as can be appreciated readily, a heavy accumulation took place within and on the sides of the open cars. This material was re-

(Continued on page 81)

Why Trains Run On Time—When Blizzards Tie Up Buses and Trucks*

By G. M. O'ROURKE
District Engineer, Illinois Central, Chicago

In this article Mr. O'Rourke reviews the painstaking preparations carried out, largely by the track supervisors, to insure that the railway personnel and equipment are ready for the emergency when it comes. He also describes the methods employed during the storm, and gives an account of the results obtained with various types of snow melting and handling equipment. His discussion embraces operations on the line as well as in terminals.

RAILROADS prepare for snow as nations prepare for war. They commence to prepare for it as soon as the season's general maintenance and renewal work is wound up in the early fall months.

The track supervisor occupies the key position in the preparation for these storms. It is his job to educate his men so that, when the emergency arises, they will know what to do and how the work can be done efficiently and with safety.

It is the supervisor's duty to inspect all facilities on his subdivision, to see that all ditches are cleaned out and that culverts and the channels of streams are clear of obstructions. Co-operating with the division water works foreman, he will see that adequate drainage and protection against freezing are provided at water columns, water tanks and treating plants.

With the signal supervisor, he will inspect all switches and interlockers to know that switch points fit tightly and that ballast is removed from between ties at all movable parts to provide a place for the snow to settle into. He arranges to have a snow broom placed in a convenient holder at each outlying switch for use by train men, and sees that a flanger sign is erected at each farm crossing and at other places where there are obstructions to track flangers or snow plow blades.

He orders salt, sand or sawdust for use in providing good footing on station platforms. To insure a constant and convenient supply of oil and gasoline during storms, he makes certain that all reserve drums are filled and that foremen are provided with orders on local dealers. He must see that snow fighting and motor equipment receive adequate attention by the supervisor of work equipment. He makes a careful check of all tools with his foremen to ascertain if adequate supplies are available.

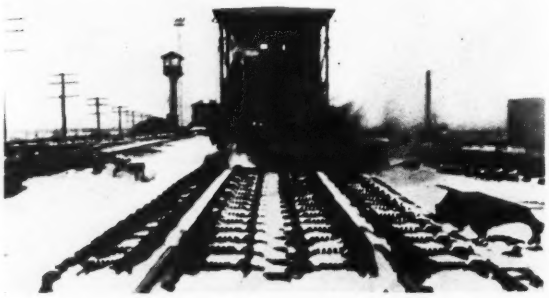
Regular men are assigned to important interlocking plants to assist the operator and maintainer, but each foreman must be in touch with additional men who, in case of urgent need, can be used to reinforce the regular force or replace it when continuous operations become necessary. However, the regular men must bear the brunt of the work, as they are familiar with their sections and know each landmark along the road. They know the usual location of snow drifts and where snow fences must be erected to prevent them. Plans are made for emergency assistance for linemen when wires and poles break under the weight of sleet.

While all of the work described above is in progress, the larger mo-

*Abstracted from a paper presented before the Maintenance of Way Club of Chicago.

bile snow fighting equipment is being tested by the mechanical department and made ready for emergency use. A schedule is prepared showing where snow plows and spreaders are to be stationed, and a definite plan is outlined for their supervision and operation.

The Illinois Central equips the pilots of freight and passenger locomotives with boards so that they can serve as snow plows. Some roads provide a pilot plow that is designed to cover or replace locomotive pilots, but much more powerful plows are needed to clear heavy drifts from the tracks.



Weed Burners Have Proved Thoroughly Effective in Keeping Car Retarders Clear of Snow

About six years ago the Illinois Central retired its last rotary snow plow because with the heavy power in use today we are able to clear our rails with the wedge or Russell plows. The heaviest snow removal work on the single-track lines of the Illinois Central is handled with single-track Russell snow plows equipped with winged elevators, 2 flangers and an ice digger. Double-end plows are used in multiple track territory to avoid the necessity for turning. Considerable use is made also of a wedge plow fastened to a loaded ballast or coal car, but this equipment is effective only in comparatively light snow.

In the Terminal

The large terminal presents a special problem, and this is especially true in a great terminal like that of the Illinois Central at Chicago, which handles 466 electrified suburban trains daily, in addition to the regular freight, passenger, transfer and switching movements. Our preparations for the battle against snow on the Chicago terminal are initiated at a "Snow Meeting" conducted in October of each year by the division engineer. At these meetings staff assignments at strategic points are outlined on a program that shows the names of the officers, their locations and telephone numbers. These assignments insure that someone is in charge 24 hours each day during the duration of the storm. Lists are distributed showing the names, addresses and telephone numbers of all track foremen, bridge, building and water service foremen, signal maintainers and electricians, and employees from various departments who are assigned to supervisory duty during severe storms, when it becomes necessary to augment the regular forces with casual labor.

The casual labor that is available is usually unsatisfactory, being without experience, sometimes improperly or scantily clothed, and often not in the best condition physically, and it takes careful handling to produce results with safety. Therefore, before hiring any casual labor we employ any furloughed Illinois Central employees who are available. However, it is necessary, at times, to hire a large force of extra laborers and these are obtained by the division engineer through supplies offered by local labor agencies.

The men are directed to the "Snow headquarters," a large room at Roosevelt road, whence they are assigned to gangs and provided with tools. An attendant, on hand at all times during a storm, checks the tools out and in.

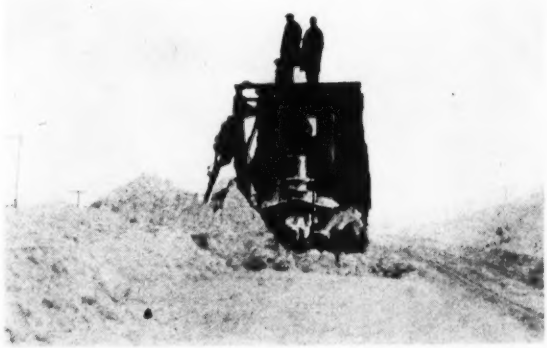
The "Snow headquarters" is under the direction of an experienced man who knows casual labor and picks men who will be of some value. Other experienced men travel over the entire terminal and keep the division engineer informed of conditions, while others visit restaurants where our men are fed to check food and conditions; to see that no one but bona fide employees are fed, and to see that prices and other matters are in accordance with agreements previously entered into with the restaurants.

Safe working conditions are necessary; engine whistles and bells should be sounded at busy interlocking plants, and headlights kept burning. In this connection, one of the most important duties of the terminal road supervisor, as winter approaches, is to see that no material is left lying around to create stumbling hazards which may cause serious injuries during heavy snow storms. He must insist that foremen make full use of the police whistles furnished them to warn men of approaching trains.

Snow Melters

Until about twenty years ago, almost the only means employed for melting snow were steam jets on locomotives, steam coils, salt and the burning of oil. Even as late as ten years ago, progress in the development of snow melting devices was slow, but since then it has been comparatively rapid, and maintenance officers now have at their command a variety of snow melting and other snow fighting devices which have demonstrated their effectiveness in terminals under the most adverse conditions of heavy snowfall, high winds and low temperature.

In the fall we move into Chicago terminal all machines and equipment that we have found useful during snow storms. Some of these were purchased primarily for snow handling, while other equipment was acquired for other purposes and later found applicable to fighting of snow. Among the latter, weed burners have been found to be especially effective.



Spreaders Equipped With Plow-Shaped Fronts and Wings Are Excellent Snow Movers

Throwing flames from two or more funnels—used for destruction of weeds during the summer—they are excellent snow melters.

Get Results

Three weed burners are assigned to Markham yard, one to South Water street and one to Hawthorne yard on the western outskirts of Chicago. They are maintained and operated by mechanics from the motor car repair shop and from forces under the supervisor of water service. At Markham yard we have two humps embracing 200 retarders that have a total length of more than 6,000 track feet, with some 12,000 pieces of spring equipment, and as snow quickly fills the space between retarder shoes and rails, a storm can quickly render the retarders inoperative. The use of the weed burner for melting snow and ice from these retarders and some 500 other ordinary and diamond switches in this yard has been the only successful method we have found for keeping our humps open for service during snow storms.

Switches through the interlocking plant at Randolph street and at Fifty-first street are equipped with electric melters of the contact type. Locomotives equipped with dome connections for steam hose leading to coils under movable parts of interlocked switches are stationed at Sixty-seventh street and at the south end of Central Station train shed. Approximately 250 other switches are equipped with "Winter King" switch heaters.

Snow Movers

Double-end wedge snow plows are assigned to Central station, Markham yard and Hawthorne yard. Ten trained operators, familiar with the location of all frogs, switches, and other obstructions are subject to call. Snow plows used today must be much heavier in construction than those of 10 or 20 years ago because of the greater power of the locomotives now used to propel them.

Jordan spreaders with a plow-shaped front are excellent snow removers. The spreader wings can be used to good advantage out on the line to widen the cuts after they are opened up, and to move snow from one track to another in large terminal yards. In this latter operation, four or five yard tracks are cleared of cars, depending upon the depth of snow, after which the spreader is used to shove the snow from track to track until it is all piled up on one track in the center of the yard, if it is a large one, or clear of all yard tracks if there are not more than five in the yard. Spreaders equipped with steel teeth set under the front edge of the plow have proved effective in cutting ice that may have formed between and over the rails. Two of our spreaders in the Chicago terminals are so equipped.

Effective use is made of caterpillar tractors, two of which are located at South Water street and one at the Fourteenth street mail and express platforms. These are equipped with either bulldozers or front-end snow loaders. The loader consists of a bucket or scoop attached to the front end of a tractor, and is loaded by the power of the tractor as it travels forward. This scoop can be raised high enough to dump over the side of a gondola car. For light snows, the scoop can be used as a bulldozer and the material piled in windrows for convenient loading.

After the Storm

As the employment of manual labor to fight storms results in a large expenditure for extra men, a great measure of elasticity must be maintained in the make-up of the forces so that there will be no delay in having men turn in their tools and depart just as soon as the storm abates. However, clean-up work must follow at once if the fighting of succeeding storms is not to be impeded by the accumulated snow of preceding storms. As soon as the snow stops falling we commence loading it into small metal dump carts pulled by a caterpillar tractor, or into motor trucks for transportation to dumping grounds or to the lake, or into gondola cars for moving out of the city. The loading is done with the caterpillar front-end loader and with cranes equipped with clam shell buckets. Comparatively little loading is now done by hand. When we are unable to cope with the situation with the trucks and trailer cars we own, we obtain additional units from local trucking concerns on an hourly hire basis.

Not the least of the advantages with which the various types of equipment can be credited is that of marked economy, as compared with methods previously in vogue. It is, of course, necessary to hold the cost of the work down to a minimum.

River Front Yards at Detroit, Mich.

Speed Tunnel Relining Project

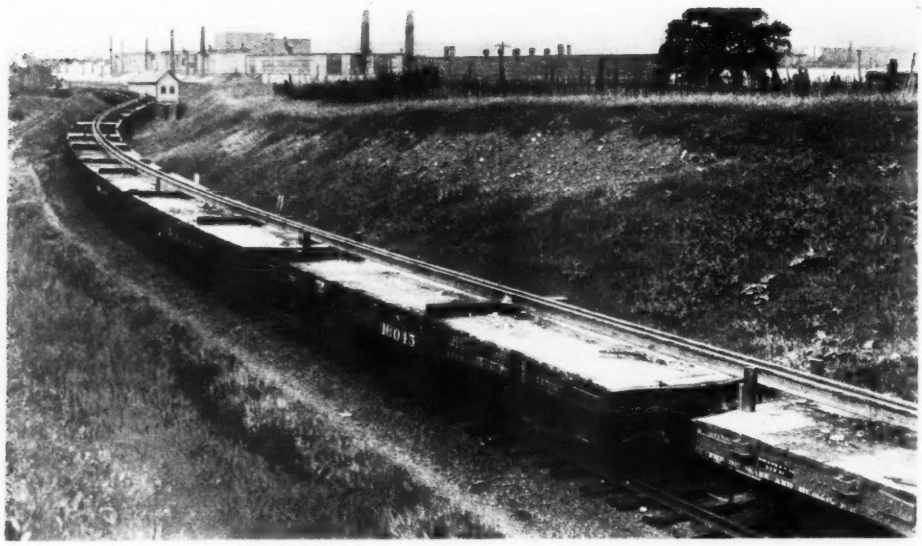
(Continued from page 78)

moved by brooms and shovels and by high-pressure air supplied by the air compressors.

Restocking the train each day involved seeing that the gasoline and water tanks were full; that kerosene and carbide water lights were provided for emergency lighting; and that there were at least 200 bags of cement and 750 bags of sand in the proper storage compartments. In other words, all possible needs of the night forces had to be anticipated and provided for before the train moved out on to the job each night.

To facilitate the work of the day crew, which included a foreman, an equipment repairman, a machine operator and eight laborers, a yard track was set aside for the train maintenance operations, which was served on one side by a service track and a driveway. Sand, which was delivered in carload lots to a large bin at one end of the service track, was bagged at the bin and was moved to the cars of the gunite train on a push car.

One of the outstanding features of the difficult work of relining the tunnel under the severe conditions of the smoke and traffic which existed, was the fact that it was completed without any serious personal injuries. The work, which was done under the general supervision of Robert Faries, assistant chief engineer, maintenance, of the Pennsylvania, and W. T. Covert, chief engineer maintenance of way of the Eastern region, was planned, engineered and programed under the personal direction of A. R. Wilson, engineer of bridges and buildings. The immediate operations were carried out under the supervision of J. M. Fox, division engineer at Baltimore; L. E. Gingerich, track supervisor, until November, 1934, when he was promoted to assistant division engineer at Jersey City, N.J.; his successor, H. W. Swartz, Jr., track supervisor; and A. C. R. Seaman, assistant master carpenter. The same equipment and organization is now being employed in relining and stabilizing certain other tunnels on the Eastern region of the road.



Welded Together on Flat Cars, the Long Rails Were Moved to Their Point of Installation Without Difficulty, Around Curves as Great as 10 Deg. 30 Min.

How Flexible Are Long Rails?

THE Delaware & Hudson, which is pioneering in the use of long rails in open ballasted track, produced by the Thermit welding of 39-ft. rails together, and which has already made two sizable installations of such rails in 1933 and 1934, has recently completed a third installation in which there are four continuous rail lengths, two 6,970 ft. long and two 4,435 ft. long. While these are the longest lengths into which rails in open track have been welded on the road, the most significant feature of the installation is the fact that the individual rails were welded together into 20-rail lengths on flat cars approximately three miles from the site of their installation, and were then transported to the point of installation on the cars.

After the rails had been barred off the cars at the point of placement, the 20-rail lengths were lined into final position in the track. Later, the adjoining long lengths were thermit-welded together in the field to form the lengths mentioned above. The two lengths in each side of the track are separated only by a standard insulated joint employed in the track signal circuit and have only standard rail joints at their opposite ends, with only the normal expansion space allowed between 39-ft. rails.

The earlier installations of long thermit-welded rails on the D. & H. were described in *Railway Engineering and Maintenance* for January, 1935. In the first of these, which involves rail lengths up to 2,700 ft., all of the welds were made in the track after the normal 39-ft. rails had been put in service. In the second installation, which involves continuous rails approximately 2,500 ft. long, the rails were welded into continuous strings while resting on blocking directly alongside the track. This latter method proved more practicable than the method used in the first installation, and particularly so because the second installation was made through the limits of a yard where there was ample level space alongside the tracks to permit unhampered welding operations. Within the territory covered by the third installation, a long high fill, relatively narrow embankment shoulders, and curves in the track involving a high ballast shoulder, did not lend themselves readily to carrying out the welding operations in the field. Furthermore, owing to traffic conditions, it was not feasible to obtain use of the track for the time necessary to do the work.

This situation gave rise to the thought of welding the rails together on a string of flat cars and then transporting them on the cars to the site of installation. Having had considerable experience with the flexibility of long rails and the strength of the Thermit rail welds under severe bending stress, there appeared to be no practical reason why this method of procedure could not be followed, especially since it promised economies in several respects. Accordingly, three tangent tracks in the road's Mohawk yard at Schenectady were set aside for the work, flat cars being lined up on the two outside tracks while the center track was used as a work or service track on which the welding equipment, preheaters, tools and materials could be moved from point to point along the cars as the welding progressed. The service track was also used by a locomotive crane employed to set the rails on the cars for welding.

Two 1482-Ft. Lengths

The rails involved in the work were of 131-lb. R.E. section, which were furnished especially prepared at the mill to be joined by the thermit welding process. More specifically, the rail heads, together with the upper 1½ in. of the webs, were machine-faced to assure clean true surfaces for joining, so that the necessity for carrying out this operation by hand in the field could be avoided. Furthermore, the normal joint bolt holes were replaced by a single hole 13½ in. from each end of the rail, which was used as an

anchorage for the clamps employed in securing the pressure necessary in the welding process.

The second two strings of rails welded together on cars included 38 rails each and were 1482 ft. long. These required the use of 43 flat cars. They were prepared successfully in every respect, through the welding, the transporting to and unloading at the site of installation, and their subsequent lining into the track. However, in all of the later work, because of the greater speed which could be effected in handling somewhat shorter lengths, the lengths welded together on the cars were confined to 20 rails, 780 ft.

This article describes how the Delaware & Hudson, in making a third installation of continuous rails involving lengths of more than a mile, found it practicable and economical to weld as many as 20 rails together on flat cars, and then to move them out on the line for laying in the track. The welding was done approximately twice as fast on the cars as would have been possible in the field under the conditions imposed, and no difficulties were encountered in moving the welded rails over sharp curves or in handling them into the track.

Two strings of rails at a time were lined up on the cars for welding. These were set approximately two feet from the sides of the cars on crossties, with the individual rails in each string placed end to end. In general, the ties used as blocking to level up the rails and afford adequate space beneath the ends for attaching the welding apparatus, were located at the center and about five feet from each end of each rail.

Details of Welds

Beginning at one end of a string of rails, the joint welds were made successively, the latest development in thermit rail welding being used, which involves a pressure butt weld of the head area and a thermit fusion weld of the base and web. The making of the fusion part of the weld is effected by bringing the rail ends tightly together, placing a mold around this junction, preheating the rail ends within the mold, generating superheated steel by means of the thermit reaction, and then allowing this steel to run into the mold where it fuses the rail ends together and forms a collar of deposited metal around the base and web. Prior to the welding operation, the base and web of each rail are cut back approximately ¼ in. with an oxy-acetylene torch, to within a distance of 1½ in. from the underside of the rail head. Thus, when the rails are set up for welding, while the heads are in tight contact, a gap of ½ in. is provided between the adjacent webs and bases.

The pressure butt welding of the heads of the rails is done simultaneously with the fusion welding of the bases and webs. The heating of the heads to welding temperature is effected by means of the slag which results from the thermit reaction, the molds being so constructed that this slag completely surrounds the abutting heads and brings them to welding temperature in a very short time after the thermit weld is poured. When the proper heat is reached, heavy clamps, which have been fastened previously to the rails, are drawn up, forcing the rail heads together under the high pressure necessary to perfect the butt weld. After the two types of welds have been made simultaneously, the joint is stripped of its molds and is complete except for grinding the top and gage side of the rail head to remove any surplus metal. Throughout the welding, the making of two joint welds progressed at the same time, one in each of the strings of rails lined up on the cars.

Organization

The full organization handling the work included two men making the sand molds for the welds; one part-time man with an oxy-acetylene torch under-cutting the ends of the rails below the head for the thermit fusion portion of the welds; one man cleaning the rail ends; two men aligning the rail, adjusting the tie blocking at the joints, putting on the pressure weld clamps, etc., in final preparation for the welds; two men placing the molds about the rail ends; two men making the welds, including the operations of preheating, pouring, stripping, and moving their equipment forward; and two men rough-grinding the surface and gage side of the rail head at the welds. On the days that the welding operations were being carried out, an average of 20 welds were made with the above force, the largest number of welds made in any one day being 24.

After the rails in each line had been welded together, the two lines of rails were barred to the center of the cars on their tie supports, to a position three to four inches apart, where

Barring One of the Long Rails from the Cars on to Tie Supports, from Which it Was Lined into the Track

there would be minimum movement as they were transported around the curves in the track to their point of installation. End stakes were provided at about every third car in the train as a precaution, but no attempt was made to fasten the rails to the cars at any point. In spite of this, there was practically no movement of the long rails as they were hauled over the line, through No. 9 turnouts and over main line curves up to 10 deg. 30 min. At the point of installation, the lines of rails were barred off opposite sides of the cars, the inside line being made to lie in the inter-track space, while the outside line was made to rest directly upon blocking at intervals of about 15 ft. along the ballast shoulder. This blocking, which placed the new rail in fairly good line and surface at about the level of the outside running rail, was built up of old ties which had been removed from the track shortly before in tie renewal and re-ballasting operations.

Tapping the Thermit Steel into the Mold

Unloading Rails

A gang of 14 or 15 men was employed in barring the long rails off the cars, and the time required to remove each rail varied from 10 to 20 min., depending upon the conditions encountered. As barred off, the outside rail lay approximately five feet from the outside running rail, and from this point had to be lined inward into the track. No difficulty was encountered at any time in barring the long rails off the cars, or in lining them into position in the track. The only unusual feature of the work of removing the rails from the cars was the precaution taken in chaining the last 150 ft. or more of the new rail to the running rail between cars, to prevent the last few rail lengths from whipping off the cars out of control. These holds consisted merely of loops of chain about the new rail and around the nearest running rail, which restricted the lateral throw of the new rail to the distance desired from the running rail.

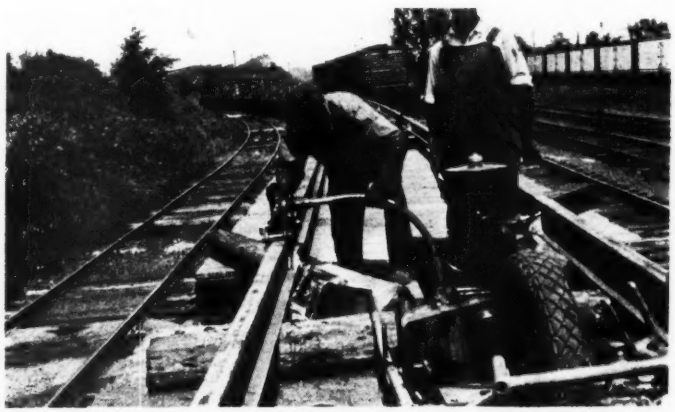
Lining the Rail

Lining the new rail over on to the track ties was accomplished in stages of about a foot at a time, working from one end. Just before the final movement of the long rails on to the ends of the ties, new tie plates of the M. & L. design, employing spring rail clips, were affixed loosely to the base of the rail. These plates, which are standard on the road and which were used in both of the other thermit welded rail installations, were located as nearly as possible directly opposite the ties on which they were to be seated to minimize the necessity for adjusting them after the rail was lined into place.

The long rails were set in on each side of the track after the running rails had been lined into the inter-track space one at a time, and the ties were adzed as necessary to accommodate the larger tie plates employed with the new rail. In the case of the two 1482-ft. lengths of rail, this lining was done, working from the center toward each end. However, with the 780-ft. lengths, no difficulty was encountered in lining them into place continuously from one end. As a rule, the final surface grinding of the head of the rail at the joint welds was done in track after the rails were laid and the track surfaced, the preliminary grinding being done on the cars. All of the grinding, irrespective of where it was done, was effected with flexible-shaft cup-wheel grinders.

Welded on Cars

Altogether, 22 of the 780-ft. lengths of rail, in addition to the two 1482-ft. lengths and two 741-ft. lengths, were welded together on cars, transported to the point of installation, and laid in the track in the manner described. As time and conditions permitted during the course of the work, the joints in the track at the ends of the long lengths of rail were



Above—Rough Grinding the Top and Gage Side of the Rail Head at Joint
Below—Men at Work on Two Welds—Preheating Operation on the Right

thermit-welded, producing the four continuous lengths of rail in the installation. Until this could be done, joint bars were applied at the joints after the necessary bolt holes had been drilled.

No difficulty was encountered in any stage of the work, and, on the other hand, in view of the fact that welding in the field alongside the track would have had to have been done under special difficulties, it is estimated that the actual welding work was accomplished in about one-half the time that would have been required to make the welds in the field. Furthermore, as the result of the method devised for transporting the rails to their final location and the making of all closure welds between trains, the only interruption to traffic was during the actual placing of the rail in final position in the track. For this operation, which required no greater amount of time than the laying of 39-ft. rails, exclusive use of the track was obtained for the time necessary to complete the laying of one or more of the long lengths.

The work was carried out by the regular track forces under the general direction of H. S. Clarke, engineer maintenance of way of the D. & H., the welding being under the immediate supervision of engineer C. E. R. Haight, and a representative of the Metal & Thermit Corporation, while the transportation and installation of the rail was supervised by Oscar Suprenant, roadmaster.

Supervisors and Foremen Commended for Good Track

ONE hundred and forty-four track supervisors and foremen on the Chesapeake & Ohio, the Delaware & Hudson and the Pennsylvania, were awarded cash prizes, or were specially commended, as the result of track inspections on these roads in 1935. While a number of roads during recent years have discontinued annual inspections and awards in connection therewith, the above named roads have continued their long-standing practice in this regard. Brief announcement of the inspections on these three roads are given below. The results of the annual track inspection on the Norfolk & Western were announced in the January issue.

Pennsylvania

The Pennsylvania, in 1935, continued its long-standing practice of making periodic inspections of all of its tracks, rating each division, subdivision and section at the end of the year and then sending letters of commendation to those supervisors and foremen whose territories received the highest ratings on their respective divisions or subdivisions. Following are the names of the supervisors and their assistants (where they have assistants) whose territories received special commendation.

New York Zone—New York division—H. J. Kerstetter, New Brunswick, N. J.; R. W. Speidel (assistant). Long Island railroad—W. L. Steltzer, Hicksville, L. I.

Eastern Region—Best of all main-line supervisors' subdivisions between Philadelphia and Altoona, and between Darby (Philadelphia) Pa., and Washington, D. C.—R. W. Riser, Maryland division, Wilmington, Del.; R. DeJaiffe (assistant). Middle division, main line—R. H. Meintel, Huntingdon, Pa.; L. P. Oelschlager, (assistant). Middle division, branch line—R. H. Joyce, Tyrone, Pa. Philadelphia division, main line—W. A. Trimble, Downingtown, Pa.; A. M. Harris, (assistant). Philadelphia division, branch line—A. J. Greenough, Harrisburg, Pa.; A. S. Hicks, (assistant). Baltimore division—H. S. Unangst, York, Pa.; J. C. Skinner (assistant). Philadelphia Terminal division—C. D. Merrill, West Philadelphia, Pa.; E. G. Adams (assistant). Delmarva division—J. E. Zullinger, Cape Charles, Va. Williamsport division—R. L. Fleming, Northumberland, Pa. Wilkes-Barre division—R. S. Dunkle, Sunbury, Pa.

Central Region—Pittsburgh division, main line—C. R. Sanders, Trafford, Pa.; A. B. Lewis, (assistant). Pittsburgh division, branch line—M. J. Miller, Barnesboro, Pa. Panhandle division, main line—J. C. Dayton, Newcomerstown, Ohio. Panhandle division, branch line—F. E. Flynn, Wheeling, W. Va. Conemaugh division—M. C. Fox, Kittanning, Pa. Monongahela division—O. L. Fisher, Youngwood, Pa. Eastern division—C. P. Sipe, Pittsburgh, Pa. Buffalo division—Carl McGhee, Struthers, Pa. Renovo division—T. M. Woodward, Kane, Pa. Cleveland division—Joseph Conlon, Alliance, Ohio. Erie & Ashtabula division—E. E. Kinzel, Sharon, Pa.

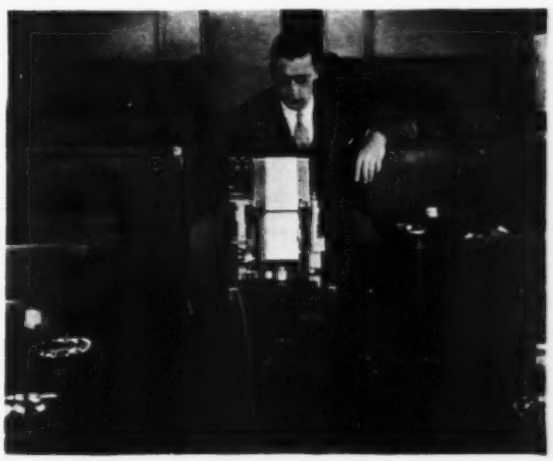
Western Region—Best of all main-line supervisors' subdivisions—Charles Weiss, Fort Wayne division, Valparaiso, Ind. St. Louis division—M. E. Boyle, Greenville, Ill. Cincinnati division, main line—A. H. Stimson, London, Ohio. Columbus division—D. Lewis, Richmond, Ind. Chicago Terminal division—J. J. Navin, Chicago, Ill. Logansport division—John Nowviskie, Crown Point, Ind. Toledo division—C. V. Frish, Carrothers, Ohio. Grand Rapids division—H. H. Russell, Kalamazoo, Mich. Indianapolis division—J. B. Hill, Indianapolis, Ind. Cincinnati division, branch line—Paul Reeves, Cincinnati, Ohio.

Chesapeake & Ohio

The Chesapeake & Ohio awarded a total of $1,810 in cash prizes to 12 track supervisors and 60 foremen for excellence in the condition of their respective territories. The inspection train included a roadway inspection car which contained a new gyroscopic track recording unit for registering graphically the physical condition of the track.

For the purpose of the inspection, the road was divided into five groups according to the character of the track and the class and amount of traffic handled. The general plan of grouping was as follows: Group 1—double-track main lines, freight and passenger traffic; Group 2—single and double-track main lines, principally freight traffic; Group 3—single-track main lines, principally passenger traffic; Group 4—secondary branch

(Continued on page 87)



Portable Gyro Track Recorder Used on the C. & O. to Show Graphically the Riding Quality of the Track

Self-Protection During Storms*

By A. H. PETERSON
Roadmaster, Chicago, Milwaukee, St. Paul & Pacific, Chicago

Strict observance of safety rules is necessary by those engaged on snow duty if accidents are to be avoided. Inexperienced extra forces must be given special attention to insure safety.

IN any discussion relating to the safety of men employed on snow duty, it is necessary to distinguish between those employed regularly as trackmen throughout the year, and who are, therefore, familiar with the safety instructions and practices of the road, and the casual labor, which possibly has never before been employed on track work of any kind and is not likely to be so employed again except possibly during later storms.

In ample time for all arrangements to be made, the regular men should be assembled for detailed instructions as to safe practices in handling snow. At this time they should be given permanent assignments as to the places where they should report in case of a heavy fall of snow during the night. This is particularly important in terminals where there are large numbers of important switch layouts and interlockings. Obviously, the most experienced and trustworthy of the regular men will be assigned to the most important situations.

All regular men should be instructed that clothing worn during the winter must be warm, but not unduly cumbersome. They should be warned praticularly concerning all of the known hazards connected with their work. Among these, especial emphasis should be placed on—

(a)—Keeping a close lookout for moving locomotives, cars and trains.

(b)—Keeping hands and feet from between stock rails and switch points. Also on keeping hands from between ties and rods in switches, especially at power-operated switches and derails at interlockings.

(c)—Avoiding, so far as practicable, the turned-up coat collar or tight ear laps over the ears. Many lives have been lost through failure to hear the approach of a train as a result of too much clothing around the head.

(d)—Complete elimination of the practice of getting on or off of the footboard of a locomotive while in motion. Switchmen often ask for a man to go some place to clean out a switch. The instructions should be specific that no man shall get onto or off the footboard until the engine has been brought to a full stop, and then on the rear footboard only.

(e)—Not stepping onto an adjacent track, if practicable to avoid doing so, when getting out of the way of an approaching train. It should be carefully impressed on the men that if it becomes necessary to step onto or across a track, they must look in both directions to ascertain whether a train is approaching on that track.

They should also be impressed with the necessity for being careful to guard themselves when clouds of smoke or steam or flurries of snow obstruct their view of moving cars or locomotives, and that if they are about to be enveloped in smoke or steam, they should stand far enough away from the oncoming movement to insure prevention of injury.

It should also be stressed that when, in the performance of their work, it becomes necessary to walk along a track, they should walk outside of the rails, allowing ample room to insure that they will clear moving trains or cars. If it becomes necessary to walk between the rails, they should always face toward the normal direction of oncoming trains, but should look back frequently, since trains may be run against the normal current of traffic.

Shoes, rubbers or overshoes having worn soles should not be tolerated. A slippery sole constitutes an especial hazard when men are cleaning switches. The surfaces of the ties are almost certain to become glass-like in their slipperiness, and unusual care must be exercised to insure against falls.

Men should never be encouraged to work more hours than their regular assignments, except when emergencies make it impossible to avoid this. There is always a temptation to work long hours in order to take advantage of penalty payments during storms. At best, handling snow is an exhausting task, and a man who stays on duty for 15 to 18 hr. becomes physically fatigued to the point where he is a distinct hazard both to himself and his companions. Rest and sleep are important factors in the avoidance of accidents.

Men on the seniority list are not likely to disregard the rules of safety. As the hazards increase during blizzards, they become more alert and watchful. Almost automatically they put into practice the safety practices which they have learned through precept and experience during former winters. Again, these men have seniority rights which they desire to protect by doing their work safely, while pride in their gang and their railway acts as a spur to practice safety.

But what of the inexperienced snow shoveler who has never worked on a railroad until the present storm gave him an opportunity? In a severe or long-continued storm, hundreds of men may be employed temporarily, who not only lack experience but are not bound by traditions of loyalty to their employer or to their fellow workmen. In general, they do not have even the slightest knowledge of trackwork or any background of safety instructions or practices.

Inexperienced men who respond to calls for handling snow are of all ages. Usually they are from among the unemployed and many of them have not worked for long periods. In all probability they are not properly dressed to withstand exposure to wind and low temperature. For these reasons, before they are sent out, they should be lined up for a short inspection. Those who appear to be too young or too old should not be employed. Every man who is allowed to go out should have mittens, a cap with ear protection and good strong shoes, and preferably overshoes in addition.

So far as practicable, inexperienced

*This discussion was submitted for publication in the What's the Answer department of the January issue, but because of its scope it was withheld for presentation here as an independent article. For further discussion of this subject, see page 36 of the January issue.

men should be assigned to work on station and unloading platforms, driveways and elsewhere where the danger from train movements is at the minimum. In some cases they can be assigned to clear the snow from industrial tracks and away from the side of lead tracks, or they may be used to load snow where hand loading into motor trucks or cars is necessary. For any of these jobs large groups of "green" men can be handled with complete safety by a few regular foremen.

If the storm is a protracted one, it is more than likely that some of the inexperienced men will be required to clean switches. If so, they must never be permitted to work alone. In all cases, experienced men must accompany them. Supervision is best accomplished by pairing a "green" man with an experienced one who knows what work is to be done and the safe way to do it. Every man on the seniority list thus becomes in effect a foreman in time of heavy snowfall. It is the foremen's duty to educate his regular men to safe practices and prepare them to assume considerable responsibility. They, in turn, must instruct and protect the inexperienced men who are hired temporarily during storms.

Obviously, there is little time to talk safety when trains are being delayed or are likely to be tied up for lack of men to clear snow and ice from switches. Only the fundamentals of greatest importance can be touched on at such a time. If it becomes necessary for a man to leave the gang temporarily, the foreman should delegate a regular trackman to accompany him to insure that he does not endanger himself by crawling under or between cars, or walk around the end of a cut, with not enough space to insure against being struck if the cars should be moved suddenly or unexpectedly.

Supervision

While every man employed temporarily should be warned of any special hazards at the place to which he is assigned, too much can not be expected of him. It is rather a matter of intelligent supervision by the regular forces. At such a time everyone is working under a strain, for trains may be late with respect to both arrival and departure, and frequently the most severe effort is needed to avert a complete tie-up. Under these circumstances, there is no time to discuss safety or to issue more than the simplest instructions. For these reasons, experienced trackmen, paired with the "green" men, are the backbone of the safety of the gang, particularly during night assignments.

Regular men who have been properly instructed in safe practices, ordinarily require little supervision during snow storms. They are familiar with conditions and alert to the hazards of their assignments and act accordingly. Many of the switches and crossovers which must be given attention are more or less isolated, and since two men can usually keep them in operation, it is neither economical nor desirable, from a safety standpoint, to have a foreman present.

It is different with new men, who should never be permitted to work alone, but only when a regular trackman or a foreman is present. In many cases, one regular man can serve as the leader for five or six "green" men. A foreman can usually supervise from three to five such groups, depending on the severity of the storm and the territory they must care for. Where there is no train hazard, such as when cleaning driveways, more men can be handled safely with a small amount of supervision. If the inexperienced snow handler is adequately clothed and is worked in company with experienced men who are alert to call his attention to train movements and other dangers, he should be under no unusual hazard.

Track Awards

(Continued from page 85)

lines; and Group 5—yards and terminals. In rating the different territories, the records of the gyro recording machine were given a value of 60, and committee markings were given a value of 40.

Prizes of $50, $40 and $30, respectively, were awarded to the three supervisors in each of Groups 1 and 2, while first and second prizes of $50 and $40 were awarded to supervisors in each of Groups 3, 4 and 5. First and second prizes of $25 and $15, respectively, were also awarded to two foremen on each supervisor's territory, and two special prizes of $50 each were awarded to those supervisors whose territories showed the greatest improvement during the year. The names of the supervisors who won the awards in the different groups follow:

Group 1—First prize—J. H. Poindexter, Peninsula subdivision; second prize—J. Henzman, Charleston district; third prize—L. E. Crance, Allegheny subdivision.

Group 2—First prize—R. R. Burchett, Barboursville district; second prize—F. P. Barrick, Paintsville district; third prize—H. S. Chandler, Rivanna subdivision.

Group 3—First prize—R. C. Watkins, Mountain subdivision; second prize—V. T. Douglas, Piedmont subdivision.

Group 4—First prize—B. Jackson, Coal River district; second prize—J. A. Bragg, Cabin Creek district.

Group 5—First prize—F. A. Dirnberg, Maumee district; second prize—J. W. Knapp, Jr., Russell division.

The improvement prize awarded in Groups 1 and 2, jointly, was won by J. Henzman, who also won the second prize in Group 1, and the similar prize awarded in Groups 3, 4 and 5, jointly, was won by R. C. Watkins, who also was awarded first prize in Group 3.

Delaware & Hudson

Thirty-one foremen were awarded cash prizes totaling $1,680 as a result of the annual track inspection carried out on the Delaware & Hudson in 1935. The ratings given were based on observed physical conditions as well as the efficiency with which the work was done.

System prizes of $50, $25 and $15 were awarded to three main line foremen; system prizes of $100, $75 and $35, to three branch line foremen; division prizes of $100, $60 and $35, to three main line foremen on each of the four main divisions; system prizes of $100, $75 and $50, to three yard foremen; and "improvement" prizes of $50 and $25 to two foremen on each of the four divisions and the Jefferson branch. The names of the foremen who won the first prizes are given in the following:

Best main line section on the system, M. Caracciolo, Susquehanna division, Afton, N. Y.; best branch-line section on the system, A. Falzarano, Susquehanna division, Sharon Springs, N. Y.; best main-line section on the Champlain division, M. Alteri, Crown Point, N. Y.; best main-line section on the Saratoga division, V. Santarcangelo, Watervliet, N. Y.; best main-line section on the Susquehanna division, M. Caracciolo, who won the first system main-line prize; best main-line section on the Pennsylvania division, G. Freeman, Moosic, Pa. The first prize for the best-maintained yard on the system was won by J. Whalen, on the Susquehanna division with headquarters at Binghamton, N. Y.

The first prizes on the several divisions, and the Jefferson branch, for those sections showing the greatest improvement during the year were awarded to F. Romeo, Champlain division, at Standish, N. Y.; Joseph Izzo, Saratoga division, at Saratoga, N. Y.; J. D. Mirand, Susquehanna division, at Delmar, N. Y.; C. Vigliotti, Pennsylvania division, at Hudson, Pa.; and G. Rogers, Jefferson branch, at Forest City, Pa.

How Good Is Timber Treatment?

Service records shed light on efficiency of various preservativ es in different woods

WHAT records are available to demonstrate the economy of treating ties, bridge timbers, fence posts, etc., to protect them against decay? How serious and widespread are the attacks of termites and what can be done to protect timber structures against their inroads? How much of a menace are teredo and limnoria to tidewater structures? What are the essential characteristics of petroleum for mixture with creosote for the treatment of ties? What are the relative merits of low-residue and high-residue creosotes for the treatment of railway timber? These were a few of the questions of direct concern to railway engineering and maintenance officers that came up for consideration at the thirty-second annual convention of the American Wood-Preservers' Association at Memphis, Tenn., on January 28-30. This meeting was conducted by President Frank Mattos, manager of treating plants of the Southern Pacific Company.

At the closing session of the convention R. S. Manley, president, Texas Creosoting Co., Orange, Tex., was elected president; H. R. Duncan, superintendent timber preservation, C. B. & Q., Galesburg, Ill., first vice-president; B. M. Winegar, Canada Creosoting Co., Montreal, Que., second vice-president; H. L. Dawson, Washington, D. C., treasurer (re-elected); and M. F. Jaeger, superintendent, Reading-Central of New Jersey creosoting plant, Port Reading, N. J., and W. P. Conyers, Jr., vice-president, Taylor-Colquitt Co., Spartanburg, S. C., directors. New Orleans, La., was selected as the place of the next convention.

Service Records

Among the service records presented, most interest was shown in those on crossties, compiled by the Committee on Tie Service Records, of which A. J. Loom, general superintendent of timber preservation and tie-treating plants of the Northern Pacific, was chairman. This report tabulated tie renewals on 27 roads, with an aggregate track mileage of 200,483, showing the average renewals per mile for 1934, and the five-year average for the years 1930 to 1934, inclusive, as well as the corresponding figures for the combined mileage of these 27 roads. These figures are shown in the table.

In addition to the following record of tie renewals, tabular summaries of data obtained from the annual inspections of test-tie installations were presented for the Burlington, the Milwaukee, the Baltimore & Ohio, the Northern Pacific and the Santa Fe.

After having made no report for several years, the Committee on Post Service Records presented a voluminous report covering 318 test sections of posts, most of which comprise installations in actual service in fences. A few of these installations, however, are purely for test purposes, the posts being set out to obtain as wide a variety of conditions as practicable. The number of posts in the individual installations ranges from 10 or 12 for test sections to several hundred for those in actual service.

These installations include wooden

Crosstie Renewals of 27 Railroads

Railway	Average Renewals Per Mile 1934	Average Five-Year Period Ending 1934
A. T. & S. F.	96	104
B. & M.	108	131
B. & O.	81	73
C. of N. J.	33	63
C. & O.	96	115
C. & E. I.	98	98
C. B. & Q.	91	109
C. I. & L.	84	100
C. C. C. & St. L.	86	75
C. M. St. P. & P.	182	187
C. R. I. & P.	60	76
D. L. & W.	88	68
G. N.	110	130
I. C.	134	134
K. C. S.	109	137
L. V.	66	59
M. C.	75	62
M. St. P. & S. S. M.	158	177
M-K-T	127	120
N. Y. C. (East)	70	77
N. Y. C. (West)	65	54
N. P.	82	101
Penna.	55	69
Reading	31	59
S. P. (Atlantic Sys.)	112	115
S. P. (Pacific Sys.)	80	107
U. P.	125	105
All 27 roads	95	104

posts treated with a wide variety of preservatives with various retentions and set out under both favorable and unfavorable conditions. They also include a number of installations of untreated posts of various species of wood and both concrete and steel posts. Some of the tests were begun as early as 1908 and 1909, and are being continued, although the posts have now been in service for 27 years. While a large number of these test installations are in right-of-way fences, a few (which are being carried out by individuals) are in other property line fences, and a few are being carried out by state agricultural experiment stations.

Additional data on the resistance of creosoted piles to attack by teredo and limnoria were contained in the report of the Committee on Marine Piling Service Records, of which M. F. Jaeger, superintendent of the Port Reading creosoting plant of the Reading-Central of New Jersey, was chairman. Records of inspections made on a large coal wharf at Portland, Me., and 13 structures on San Francisco Bay were presented in the report. The data for the structures on San Francisco Bay were a continuation of those given by this committee in former years.

Treated Timber on Central of Georgia

A paper of special interest to railway men, describing the experience of the Central of Georgia with the use of treated timber, was prepared by H. F. Sharpley, assistant chief engineer of that road, and read in his absence by L. H. Harper, superintendent of the Macon, Ga., creosote plant. After reviewing the early days with its abundance of timber and the growing scarcity as the forests were cut, Mr. Sharpley described the pressure treating plant which this road built at Macon, Ga., in 1912, and in which during the 23 years of its operation more than 10,000,000 crossties, 33,000,000 ft. b.m. of switch ties, 76,000,000 ft. b.m. of bridge and miscellaneous lumber and about 2,000,000 lin. ft. of piling have been treated. The various steps were traced through which improvement has been made in the preparation of the timber and in the treating process.

Mr. Sharpley cited some of the early failures of bridge timber, which were due to the framing of the treated timber in the field, for which reason this plant now pre-bores and pre-frames all material so far as practicable, including wooden trestles, ties for steel bridges, water-tank frames, trusses for overhead highway bridges and all railroad crossties.

Service records were given for six open-deck pile trestles ranging in length from 62 ft. to 1,164 ft., all of which were built in 1913. All piling and lumber, except the ties and guard rails, were treated by the full-cell process with approximately 17½ lb. of creosote per cu. ft. In 1932, the following losses had occurred in the various members:

Members	Per cent
Piling	8
Caps	16.4
Stringers	0.5
Braces	....

From these data it was concluded that an average life of 25 years could be expected for all treated members except the caps. The ties and guard rails, being of untreated cypress, were not included in this estimate. The large percentage of failures in caps was found to be due to excessive checking of the timbers, permitting early decay.

Test Tie Sections

In 1921, an experiment was undertaken with crossties on a section of dirt track with light traffic and low speed where decay would be the governing factor in tie life. Five different sections of 200 ties each were laid, with ties having retentions varying from 3.63 lb. to 10.68 lb. of creosote to the cubic foot of timber. In 1935, after 14 years, the percentages of renewals ranged from 57 in the case of one of the light treatments down to no renewals among ties with a retention of 10.68 lb. As a general rule, in this experimental lot, the percentages of renewals correspond conversely with the amount of oil introduced in the treatment.

For the three years preceding 1913 (when the first treated ties were used), the renewals of untreated ties averaged 898,000 per year. From 1925 to 1930, the annual renewals averaged only 443,000, a reduction of more than 50 per cent. The present rate of renewal is 300,000 annually, with the probability that future normal requirements will not exceed 350,000 a year. This estimate is based on an average service life of 20 years which, considering the adzing and boring of ties, the 7-lb. treatment now given with an 80-20 creosote-coal tar solution, and the use of larger tie plates, is not an unreasonable expectation.

Revised Specifications

A new development of the year was the initial report of a special committee, headed by R. S. Belcher, manager treating plants of the Santa Fe, on the co-ordination of the various specifications of the association for the treatment of timber for different uses. This committee presented a master specification for tentative adoption.

Following this, revised specifications for the preservative treatment of ties by pressure processes was presented, for tentative adoption, by a committee on pressure processes of which W. E. Jackson, superintendent of the Santa Fe Tie & Lumber Preserving Company, was chairman. The revisions consist largely of a rearrangement of the material in the older specification, which it is intended to supersede with the substitution of maximum pressures and temperatures during the treating period in place of the former provision for minimum temperatures and pressures. In general, the averages for the temperatures and pressures during this period are left unchanged. An important addition covers the results of treatment, including the retention of preservatives and the method of calculating this retention for various treatments and preservatives; and the penetration obtained and the method of determining the penetration. All standard processes of timber treatment are included in the specification. The specification does not, however, include the preservative treatment of Douglas fir, larch or tamarack.

Creosotes

More than usual interest was displayed at this convention in the character of the creosote required for best results, stimulated in large degree by the deviations in the specifications for creosote of a number of leading roads from the specifications of the A. W. P. A. and the American Railway Engineering Association.

The Committee on Preservatives, of which R. E. Waterman, chemist, Bell Telephone Laboratories, was chairman, included in its report a paper by E. W. Carlson and W. C. Winning of the Esso Laboratories on the Compatibility of Creosote and

Petroleum. Many roads are now using creosote-petroleum mixtures for treating ties and considerable trouble has been experienced with sludging when creosote and petroleum are mixed. This paper presented the results of an investigation to determine the degree of sludging which occurs with mixtures of various creosotes and various petroleums, the amount of sludge formed in a creosote-petroleum mixture being the primary measure of the compatibility of its components. As a result of the information obtained during the investigation, it was concluded that the specific gravity of petroleum appears to be a convenient criterion for judging its compatibility with creosote, and it was suggested that the minimum specific gravity for petroleum in such mixtures be limited to 0.96. It was also stated that "there is no lack of oils of such specific gravity, and with the cracking of oils on the increase and new solvents and chemical processes coming into use which also use heavy by-product oils, there need be no fear of a shortage of heavy petroleums for wood preserving purposes."

Toxicity of Creosote

Among other features, Walter H. Snell, associate professor of botany, Brown University, and L. B. Shipley, chemist, Bermuth, Lembcke Company, Inc., presented a paper entitled, Creosotes—Their Toxicity, Permanence and Permanence of Toxicity, which aroused great interest. This paper described an investigation into the initial toxicity, the permanence, and the permanence of toxicity of different types of creosote and of mixtures of creosote with known amounts of coal tar and of petroleum. These creosotes and their mixtures were subjected to highly accelerated evaporation tests and their toxicities were determined at various periods of exposure up to the point where there were no further losses from evaporation. The authors concluded that materials of higher initial toxicities continue to possess this characteristic during all periods of exposure up to the point where there are no further losses from evaporation; and that low-residue creosotes possess a sufficient permanence of toxicity to assure a reasonable degree of safety for wood preserving purposes, while the degree of safety for wood preserving purposes might be seriously questioned in the case of the higher-residue creosotes. They also concluded that the addition of petroleum decreases the toxicity of the mixture to an extent appreciably greater than that due merely to its dilution of the creosote, and that coal tar has the same effect when added to the creosote. These conclusions were challenged by E. O. Rhodes, technical director, American Tar Products Company; Henry Schmitz, professor of forestry, University of Minnesota; Ernest Bateman, senior chemist, United States Forest Products Laboratory, and by F. E. Cislak, chemist, Republic Creosoting Company.

Treating Jack Pine

Among other papers of interest to railway men was one presented by J. F. Harkom, chief, division of wood preservation, Forest Products Laboratories of Canada, on the Creosote Treatment of Jack Pine. This paper described a series of experiments made at the Canadian laboratory to determine whether a treating schedule can be developed for jack pine that will provide better penetration with a 70-30 creosote-coal tar mixture than is obtained with the Rueping process at present in use. In this experiment, 7-in. by 9-in. jack pine ties were sawed into 12 sections each, after they had been incised and bored. To obtain uniform results, holes were also bored in the sections from the center of the ties to correspond with the holes in the end section. Penetration was determined by sawing the specimen lengthwise and measuring the untreated area with a planimeter.

All of the ties were submitted to an initial air-pressure of 60 lb. for 30 min. After the preservative mixture was introduced, the pressure was increased to 180 lb. per sq. in. and the temperature maintained at 190 deg., F. (except in two charges where the temperature was 150 deg., F.), for periods varying from 22 min. to 3 hr. 40 min. This was followed by an expansion bath at 220 deg., F., for 1 hr. 30 min., after which a final vacuum was drawn. The most effective treating schedule was found to be the Rueping treatment, followed by an expansion bath at 220 deg., F., with a temperature during the pressure period of 150 deg., F., rather than 190 deg., F.

Similar Results

The following methods of carrying out the treatment produced substantially similar results: Rueping, followed by expansion bath; oil bath, Rueping treatment and expansion bath; Rueping treatment with pressure released; Rueping treatment with slowly rising pressure; a 50-50 creosote-coal tar mixture, Rueping treatment; Rueping treatment, initial air for 10 min.; and standard Rueping treatment.

It was stated in conclusion that "the results indicate that penetration in pressure-creosoted jack pine can be improved by the use of a final expansion bath, and that the expansion bath can be made more effective by lowering the cylinder temperature during the pressure period."

Rough Track Derails Train

A DERAILMENT involving 13 cars in a freight train on the Chicago, Rock Island & Pacific near Bland, Mo., on August 8, 1935, was ascribed to irregular cross level, in a report of the Bureau of Safety of the Interstate Commerce Commission. The train involved in the accident was an eastbound freight on the St. Louis-Kansas City division and was traveling at a speed of 30 to 40 miles per hour at the time of the accident.

The track in the vicinity of the accident is laid with 85-lb. rail, with 20 ties to the rail and ballasted with gravel to a depth of 18 in. According to the inspectors of the bureau, the track was "generally maintained in fair condition." However, they found numerous ties shifted from their normal position and deeply cut by tie plates. Track levels, taken at rail joints and centers for a distance of 19 rail lengths westward from the point of derailment, showed variations in cross level of as much as 1¾ in. Within this distance there were 14 low spots in the south rail, 13 in the north rail and 9 points where the track was level.

In its discussion of the accident, the bureau stated that the evidence indicated that the front wheels of the leading truck of a tank car were the first to be derailed, followed by the rear wheels of the same truck. The indications were that when the front wheels of this car encountered the spot where the north rail was 1¾ in. low, it started to rock and that when the wheels reached a spot where the opposite rail was 1 in. low, the rocking was increased sufficiently to lift the wheels off the rail.

Effect of Ballast on Tie Life

Does the kind of ballast have any effect on the life of treated ties? Of untreated ties? If so, what? Are hardwoods or softwoods more affected? Why?

May Be Two Effects

By H. R. CLARKE
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Chicago

Ballast may affect the life of ties in either of two ways, chemically or physically, or by a combination of the two. If ballast contains any chemical that will react on a tie, either treated or untreated, its life will be increased or decreased, depending on the effect of the chemical. So far as I have observed, however, the ballast materials with which I am familiar contain no chemical which reacts on the ties, either treated or untreated. These materials include crushed rock, crushed and washed gravel, pit-run gravel, smelter slag, blast-furnace slag, burned clay, cinders and chatts.

Some of these materials, chatts for instance, retard the growth of vegetation, probably because of some chemical which they contain. Smelter slag also retards the growth of vegetation, since when it is put into the track it is entirely free from material which would encourage such growth. Obviously, this retardation is an advantage, in that it insures better drainage and the ballast does not hold moisture as it does where there is a heavy growth of vegetation.

Some of the harder and more angular materials having sharp edges affect the tie physically, causing more wear. This is true particularly of the harder crushed rocks, smelter slag, blast-furnace slag and similar materials. This mechanical effect is noticeable on the under side of the tie where the ballast tends to embed itself in the wood. In some cases, if there is movement of the tie, there is a noticeable amount of abrasion of the wood. This is generally most noticeable in that portion of the tie where the heaviest tamping is done, that is, directly under the rail. So far as I have observed, however, this abrasion has never been so extensive as to affect the life of the tie seriously.

On the other hand, an injurious effect of this abrasion may be expected in those species of timber which do not take treatment readily, and in which the preservative does not penetrate deeply; that is, the outer protective coating of treated wood may be worn away, exposing wood that is untreated or only partially treated. The tie would then be subject to decay.

Those species used for tie purposes on the Burlington either take treatment readily, assuring proper penetration, or are incised before treatment to permit sufficient penetration so that the wearing away of the surface does not extend deep enough to expose untreated wood. For this reason, we have not observed any injurious physical effects from ballast on the life of the ties.

Proper drainage is essential to the maintenance of good track. Ballast which permits the track to drain readily will doubtless tend to increase the life of ties, for if the ballast bed holds moisture, thus keeping the tie wet continually, decay will be more rapid in a treated tie, and certainly in one that is untreated, than will be the case where proper drainage is afforded. Lack of drainage will increase the amount of track work, that is, the smoothing of the surface and the tamping of the ties, and this frequent disturbance of the track will have an injurious effect on the ties. This does not depend so much on the kind of ballast, however, as on the condition in which the ballast is maintained, although some kinds of ballast become foul, and thus retard drainage, more rapidly than others.

A ballast which is unstable, or "shifty," and which therefore tends to develop center-bound track, will

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in April

1. *How frequently and in how much detail should rail in main tracks be inspected for evidence of approaching failure? Why? Who should make this inspection?*
2. *Where a brick platform is worn enough to interfere with the movement of trucks, can it be repaired without replacing the worn bricks? If so, how?*
3. *What essential characteristics must a rail joint possess to minimize damage to the rail ends?*
4. *How does one go about renewing the deck of a ballast-deck trestle under traffic?*
5. *What are the relative merits of one large gang or several smaller gangs in a large switching yard?*
6. *What considerations determine the type and size of wells required to obtain water from underground sources?*
7. *Should the entire allotment of ties be shipped to a section before the renewal season opens, or should they be shipped as needed? Why?*
8. *Is it practical to build up corroded rivet heads by welding, or should the rivets be replaced? Why?*

have an injurious effect on ties, as, again, track maintenance will be increased, and the possibility of ties breaking at the center will be much greater than if the ties are supported throughout their entire length.

These factors which may affect tie life will, I think, affect treated and untreated ties about alike, except that since untreated ties are more subject to decay than those that are properly treated, any condition which tends to hasten decay will be more noticeable in those that are not treated. As between hardwood and softwood ties, the same distinction can be made, emphasizing particularly the matter of wear, which of course will be more noticeable in softwood than in hardwood ties.

Size Has Some Effect

By J. B. Martin
General Inspector of Track, New York Central, Cleveland, Ohio

It is my observation that the size of the ballast has an influence on the life of ties, particularly on the hardwood varieties. Many ties of this class fail from splitting and checking and from decay that is accelerated by the splitting and checking. Ballast with larger voids which permit a comparatively free circulation of the air around the ties, tends to promote this checking. On the other hand, the finer materials with small voids overcome this tendency somewhat, particularly if the ballast section is well filled out. Yet, in deciding on the kind and size of ballast to be used, there are many other factors to consider. These include durability, drainage, the ability to withstand heavy traffic without displacement or undue settlement, and other features of local importance. Any one or all of these factors may be of greater importance than the probable effect on the life of the ties, although this should not be ignored but should be accorded all the consideration to which it is entitled.

Affects in Several Ways

By W. H. King
Section Foreman, Missouri Pacific Lines, Francitas, Tex.

Ballast affects ties in several ways. Some materials are coarse and hard and have sharp edges which cut into the bottom of the ties. These materials generally provide satisfactory drainage if they are properly maintained. Where practicable, hardwood ties should be used in track ballasted with these materials. Other materials, usually the finer types such as the pit-run gravels, may not allow, or at least may retard, free drainage to such an extent that the ties are kept moist and are, therefore, more readily susceptible to decay. Obviously, untreated ties will be more affected in this case, although treated ties may be affected almost as seriously unless deep penetration of the preservative has been obtained. On the other hand, splitting, particularly of hardwood ties, is more likely to occur with the coarser ballasts, while the finer materials tend to retard splitting, probably because they do not allow the wood to dry out so rapidly as the coarser materials.

Blue Stain in Lumber

What is blue stain in lumber? Does this stain affect its use? If so, in what way? How can it be prevented?

Does Not Affect Use

By W. A. Summerhays
Manager Forest Products Bureau, Illinois Central, Memphis, Tenn.

Blue stain is a discoloration of the sapwood which develops when logs have been allowed to lie on the ground too long in warm damp weather, or when green lumber has been piled too closely under similar conditions. While blue sap stain is found most generally in pine lumber, brown and red sap stains occur in various other woods, particularly oak, maple and gum. Lumber cut in the early spring or summer months is more likely to become sap stained than lumber cut in the fall or winter.

Sap stain is caused by a fungus of the genus *Ceratostomella*. It develops when the tiny spores of the fungus lodge in the fresh sapwood and germinate. The food of this fungus consists of starches and sugars stored in the sapwood, for which reason the growth does not extend into the dryer heartwood cells. During the period of growth the familiar blue color, known as blue stain, makes its appearance. Because the fungus lives on the food of the tree rather than the cell walls (cellulose), it does not damage or weaken the lumber and blue stain is, therefore, not a defect, except where the natural color of the wood is desired for finishing purposes.

Despite the fact that the blue-stain fungus does not of itself harm the lumber, an inspector grading lumber must bear in mind that the conditions which are favorable for its germination and growth are moisture, a temperature between 75 and 100 deg. F., and stagnant air, exactly the same conditions which are favorable for the development of the wood-destroying fungi which cause decay. These latter fungi working on a piece of lumber already containing blue stain, will produce a distinctive brown and bleached-out discoloration and will soon produce a punky wood.

A common method of preventing or overcoming sap stain is to dip the freshly sawed boards in a hot or cold solution of either sodium carbonate (soda ash) or sodium bicarbonate (baking soda). A concentration of 4 to 6 per cent is sufficient if the weather is dry but should be higher if it is wet. A number of proprietary preparations widely used by southern pine sawmills also give excellent results in preventing sap stain.

Kiln Drying Effective

By H. R. Duncan
Superintendent of Timber Preservation, Chicago, Burlington & Quincy, Galesburg, Ill.

Blue stain is a bluish or grayish discoloration of the sapwood of lumber, which is caused by the growth of certain species of fungi on the surface and interior of the wood. The fungi causing these stains are microscopic plants which must have organic matter on which to live and the sap juices in the wood provide the required food supply. Their development is dependent, however, on suitable temperature and humidity and their growth is accelerated by poor air circulation.

Blue-stained lumber may have become infected with the organism causing the blue stain at any time after the log was cut. To prevent this infection, precautions in yarding the logs and in piling, storing and handling the finished product are essential. The best results are obtained by first peeling the logs, then piling them on high skids in a well-drained yard where they will obtain the maximum amount of sunshine and natural air circulation. When this is done, however, care must be exercised to avoid excessive checking and yet secure sufficiently rapid seasoning to insure against early damage from the

fungi. Antiseptic sprays and coatings applied to the ends and barked surfaces of the logs are effective for the usual period of storage. Kiln drying the lumber promptly after it has been sawed will also prevent blue stain, as well as attack from other fungi, provided the wood is stored under conditions that are not conducive to decay.

Any lumber which contains blue stain should be looked on with some suspicion, for the reason that the conditions under which the blue-stain fungi grow are also conducive to the development of decay-producing fungi. On the other hand, the blue stain occurs only in the sapwood and ordinarily has little effect on the strength of the wood.

Blue-stained lumber can be used for any purpose in which appearance is of no consequence and under conditions which permit the use of the sapwood. Many persons object to using it in any place where it is to be covered with varnish, since it is unsightly and if there is considerable humidity the staining fungi may grow and break through the paint, making an unsightly appearance. Yet there is no reason why it cannot be used in any type of construction where the conditions are reasonably dry.

How Does Line Affect Riding?

What effect does irregular line have on the riding qualities of the track? On track maintenance? Why?

Good Line Essential

By E. P. Safford
Supervisor of Track, New York Central, Silver Springs, N.Y.

Good line, level, surface and gage are essential to good-riding track. These elements are so interdependent that any defect in one will quickly produce a corresponding defect in one or all of the others. Irregular line causes a rolling and lurching movement in passing equipment, with severe "side swings" which are uncomfortable to passengers and, as their severity increases with speed, may become unsafe at high speeds.

Much unnecessary lining may be avoided when surfacing by exercising care to place the jacks upright and opposite each other, and then requiring the jackmen to lift them together. Newly surfaced track should be lined carefully as the surfacing is completed, sometimes twice during the day, and touched up the following day.

Tends to Spread Track

By O. J. Smith
Rail Gang Foreman, Chicago & North Western, West Chicago, Ill.

When track gets out of line, it is almost certain to become out of level and out of surface. If not corrected, these conditions become progressively worse and rough-riding results. As these conditions develop, the rails are subjected to severe lateral pressure and heavy blows from the wheel flanges, which tend to produce irregular side wear on the head from the grinding action of the flanges.

These blows strain the joints, loosen the spikes, tend to spread the rails or tip them over, and to shift the ties on their beds. They also cause kinks or "elbows" in the track. If the track is neglected, these shocks grow progressively more severe, increasing the damage to the track and, at high speed, may result in derailment. Not the least of the undesirable features of irregular line and its effect on other elements of the track is that the lurching and "side swings" of the cars are very unpleasant to passengers, and may cause damage to some classes of freight.

Grows Worse Progressively

By L. A. Rape
Extra Foreman, Baltimore & Ohio, Wampum, Pa.

Irregular line has an extremely adverse effect on both the riding qualities of the track and on maintenance since it ramifies to produce defects in almost every element of track structure. It causes cars and locomotives to roll and lurch, this effect being intensified as the speed increases until the comfort of passengers is destroyed and safety may be impaired. At high speeds, irregular line has more effect on the riding qualities of the track than irregular surface of the same order.

An irregularity in line grows worse with the passage of every train as the lateral shocks it creates continue for some distance beyond the irregularity itself. Both the initial shock and those succeeding exert a heavy lateral pressure against the rail, as the wheels tend to resist displacement, thus causing the line to become more irregular. In turn, the grinding action of the flanges wears the rail irregularly and the sudden application and release of the lateral pressure wear the tie plates, spikes, ties and joint fastenings. At the same time, they tend to move the ties on their bed as the pressure shifts from one rail to the other, thus creating irregularity in the gage, level and surface.

Has Adverse Effect

By Thor Monrod
Track Supervisor, Northern Pacific, Reed Point, Mont.

Irregular line has an adverse effect on the riding qualities of the track, the degree depending on the severity of the irregularity. It also causes undue wear on rails and track fastenings, frequently creating irregular gage, while it invariably results in bad surface. In addition, it creates an unnecessary but indeterminate amount of wear and strain on both motive power and cars. The irregularity of motion which is produced in cars in passenger trains causes unpleasant sensations and discomfort to passengers and sometimes apprehension.

Where the line is irregular, it is practically impossible to maintain good surface, since trains running at speed are thrown from side to side, causing sharp side thrusts against the rail, thus increasing the irregularities. It also gives a lateral motion to the ties which affects their bearing and the surface soon becomes defective also. It should be borne in mind that the line does not have to be grossly irregular to produce these effects, for even slight irregularities in the detailed line produce the effects which have been mentioned. For these reasons, it is a waste of time to surface track unless it is also lined as nearly perfect as is practicable.

Magnified in Winter

By Henry Becker
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

Good line is the most important requirement for both good riding track and effective maintenance, for if the track is out of line there is nothing else one can do to make it ride smoothly. Likewise, irregular line is certain to be reflected in irregular gage, worn spikes causing loose rail, wear on the tie plates and kinked joints. All of the foregoing difficulties are magnified if the track is allowed to freeze with irregular line. In moderate weather the surface and

level will suffer correspondingly with the degree of line irregularities. In fact, the riding qualities in the winter will be considerably worse than in the summer. Poor line also tends to cause spreading track and, as the wheels are thrown from one rail to the other, the irregularities grow worse, while an increasing amount of track becomes affected. Where the irregularities are allowed to become severe, a point is reached where danger of derailment becomes imminent, particularly if the locomotives or cars have more than the normal amount of lateral motion.

Tie-Plating Unplated Ties

When laying rail, where only a part of the ties have tie plates, should new tie plates be applied to the previously implated ties by the rail gang? Why? If not, when and by whom should they be applied?

Not by Rail Gang

By B. E. Haley
General Roadmaster, Atlantic Coast Line, Lakeland, Fla.

I have always held that a rail gang should do no other work than lay rail, except such incidental items as are necessary to leave the track in condition for operation. A rail gang is a highly organized special unit and, usually, an expensive one. If it is required to do other work than lay rail, the resulting confusion and delay add to the cost of the work. It is our practice to follow immediately behind the rail gang with a surfacing gang, which by its very nature is able to complete the small items incidental to laying the rail, without additional expense or delay. This gang should apply the plates, because a certain amount of gaging is always necessary and the spikes must be pulled and the holes plugged to do this, while the plates, if applied by the rail gang, must be shifted and those on ties to be renewed must be taken off and replaced.

If the track is not to be raised, the next best plan is to have the plates applied as the ties need renewal. It has been a consistent practice on our road to apply tie plates to new rail in either of these ways as conditions justify. The only exception to the rule is that where traffic density requires full plating at once we require the rail gang to apply the plates with the rail, since there is no other choice. In this case, the proper procedure is to pull all four lines of spikes.

Should Be Left Off

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell Ky.

Where only part of the ties have tie plates, it is obvious that the bearing faces of the ties are not in the same plane, those that are unplated being higher by the thickness of the plates. For this reason, if tie plates are applied out of face as the rail is laid, the support for the rail will be higher over the previously unplated ties than over those that have been plated. Obviously, therefore, under the conditions laid down in the question, tie plates should not be applied to those ties that have previously been without plates. This refers particularly to new rail on main-line tracks, and is based on the assumption that most or practically all of the ties had tie plates under the old rail.

On the other hand, if released rail is being laid on a secondary track or a branch line, where none or only a few of the ties have tie plates, it will be desirable to apply the plates out of face as the rail is laid. In this case, if there have been no tie plates previously, there will be no difficulty in doing this. Where a few ties have been plated, it will be necessary to tamp them up to a full bearing against the rail, but this is a small matter.

In the event that only a few ties are without plates, it will be necessary, if plates are applied to them when the rail is laid, to tamp enough ties on either side of them to insure a smooth-riding surface. The other alternative is to adze through to the elevation of the previously plated ties, which obviously is not desirable. For these reasons, the new plates should be omitted from these ties and they should be placed by the surfacing gang which usually follows closely behind the rail gang.

Caring for Tipping Abutments

Where a concrete abutment shows signs of tipping, what should be done?

Reduce Soil Pressures

By M. Hirschthal
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N.J.

As soon as signs of tipping are discovered in an abutment, falsework should be provided to relieve it of the load being transmitted by the bridge. This can be done by either timber bents in front of the abutment or, in the case of a steel truss of long span, bents at panel points. An analysis of the abutment should then be made to determine the maximum toe pressure and thus determine whether the bearing power of the soil is being exceeded.

Almost invariably, the tipping of abutments and retaining walls results from an excess compression of the soil under the toe of the abutment or wall. This in turn is due to a resultant unit soil pressure greater than the soil at this point can carry without appreciable settlement. This condition may result from the use of unusually heavy material in the backfilling, from an accumulation of water in the filling material because of ineffective drainage, from a base section that was inadequate, in the original design, or it may be that an addition has been made to the original height of the abutment or wall.

Remedies that may be applied in any of these cases fall into two types. The first is to reduce the pressure against the abutment or wall; the other is to underpin the base and provide a new, or an additional, base for transmitting the pressure to the soil, which will have an intensity no greater than its safe bearing power without appreciable settlement.

It is only occasionally that the first remedy is attempted, except where drainage will effect a cure, but it should be mentioned. It consists of substituting a granulated slag or cinder fill, weighing 60 to 70 lb. a cu. ft., for the heavier material which is causing the tilting. This also includes thorough drainage to increase the angle of repose and thus reduce the resultant pressure against the abutment which in turn reduces the toe pressure on the soil. Another method which has sometimes been used with success, is to connect the top of the abutment, by means of ca-

bles and structural members, to dead men placed a reasonable distance back of the abutment.

Probably the most satisfactory method is to underpin the footing with a concrete base, so located as to bring the resultant as nearly at the center as practicable, thus reducing the pressure at the edge to the point where there will be no appreciable settlement. Analysis of the abutment section for the minimum conditions of loading and the known weight of the back filling and its pressure, as well as for the unloaded condition, will determine the resultant in each case, thus permitting provision for a base of suitable width.

It is important that the excavation for the new base be made carefully in sections of small size and at distances no further apart than these sections so as not to endanger the stability of the abutment, remembering that the load of the superstructure is being carried on falsework. It may be necessary in some instances to carry a concrete facing for some distance above the footing. This occurs particularly where an addition has been made to the original height, say, by reason of a change in grade, without corresponding provision having been made to increase the width of the lower section or base of the abutment.

If the tipping occurs in an abutment which is in contact with a stream, examination should be made to determine whether there has been erosion. If so, provision should be made to overcome this by constructing a cofferdam, preferably a line of sheet piling, and placing concrete by means of a tremie or by means of pumping (preferably a pressure application) to provide both a bearing sufficient to overcome the tipping and a base of sufficient depth to withstand additional scour.

Underpinning Best Remedy

By General Bridge Inspector

It is my observation that abutments begin to tip only when some condition arises to increase the pressure at the edge of the footing above the carrying power of the soil. This may result from raising the abutment during a change of grade, from saturation of the foundation through some external cause, thus reducing its carrying power, or from partial erosion of the earth in front of and below the footing. Occasionally, saturation of the filling back of the abutment may cause tipping. Usually, this can be corrected by drainage. In the remaining cases, underpinning generally provides the most satisfactory remedy, although I have seen a few cases where this did not effect a cure and it became necessary to remove the abutment and replace it on a pile foundation or on a footing of larger area. Even where underpinning is resorted to it may be desirable to drive one or two rows of piles to provide a better support. When an abutment begins to tip it is advisable to relieve it of its load as quickly as practicable, this being done usually by placing the superstructure on falsework.

Safety demands that the minimum amount of the excavation be removed at any one time. This makes it necessary to place the underpinning in relatively narrow sections, which should not be done progressively but should be carried out symmetrically about the center, say at the corners first, then at or near the center, alternating in this manner so that the structure will be supported evenly at all times. If the tipping is due to erosion, it may be advisable to provide an apron in front of the abutment, sufficient to protect against deeper scouring.

When an abutment shows indications of tipping, an immediate and thorough investigation should be made to learn the cause. This should be followed by an analysis of the forces acting on the structure and a determination of their effect on the foundation. Otherwise it will be impracticable, in most cases, to develop a solution which will assure a correction of the trouble.

Overstress in Light Spans

When inspecting light steel spans, how can one detect evidence of overstress?

Excessive Deflection

By B. R. Meyers

Assistant General Bridge Inspector, Chicago & North Western, Chicago

All types of spans show excessive deflection when overloaded. This is usually accompanied by abnormal lateral movement or vibration. In addition to these general phenomena, each type has its own particular indications. I-beams may develop horizontal cracks in the webs, especially over the bearings, or the flanges may become deformed at the bearing points. In extreme cases, there may be actual buckling in the web at the ends of the beam. On the other hand, girders supporting ties may develop cracks in the fillets of the top flanges, as a result of either excessive flexure in the ties or insufficient metal in the flange angles.

All types of girders may develop fillet cracks in the bottom flanges at the bearings. This is caused by the wearing down of the end stiffeners, by insufficient section for these members, by sole plates that are too small in area or too thin, or by angles of insufficient section in the bottom flanges. Again, bridges of this type may develop cracks or bending in the bottom flanges along the front edge of the sole plates.

Through plate girders and truss spans usually develop defects in the floor system first, developing cracks in the fillets, or "roots," of the hitch angles, or through a vertical line of rivets in the connection; cracks may also occur in the gussets. Again, actual failure of the rivets in these connections may take place. Overloading is usually indicated in trusses by deformation or failure at the bearings. Another indication is incipient looseness of the rivets in connections. Pin-connected trusses may develop wear at the pins, allowing the lower chord to lengthen, thus producing sag in the span.

All types of spans having laterals and cross bracing generally develop loose rivets first, followed by failure of the rivets, connecting plates or the bracing members. Some of the foregoing defects may develop from displacement of some part of the substructure. In this case, they should not be interpreted as indications of distress from overloading until a thorough investigation has been made.

Indications Are Many

By Assistant Engineer of Bridges

Assuming that the span is properly supported, overstress can come only from the overloading of the span as a whole or of some of its members. Lack of proper support by reason of settlement of the substructure or of a bearing, or displacement of the span may cause overstress in certain members that is not due primarily to overloading. It is usually not difficult to trace these to their source, however.

Excessive deflection is probably one of the most obvious signs of

overstress in a span of any type. In many cases this is accompanied by noticeable lateral movement, or swaying, or by marked vibration. In a pin-connected truss, the pins and the pin holes in the eye bars may be quite badly worn, allowing the span to sag and thus simulate excessive deflection. This wear may result from long use of the span and not be, in itself, an indication of overloading, but it should be viewed with suspicion, especially if there are other indications of overstress.

In the older designs of light spans, the floor system is generally one of the weakest features of the design. For this reason, especial attention should be directed toward the possibility of cracked angles, plates or gussets and of loose or failed rivets in the stringer and the floor-beam connections. Stringers and floor beams are quite likely to develop cracks along the fillets of the top flanges and occasionally in the webs. Not infrequently, cracks appear in the webs of the floor beams in or adjacent to the stringer connections.

Cracks appearing along the fillets of the angles forming the top flanges of deck plate girders are usually an indication of overloading, but may be the result of flexure in the bridge ties, especially where the girders are placed on wide centers. Similar cracks may appear in the bottom flanges at or near the bearings, particularly if the end stiffeners have not been reinforced. Numerous other indications might be mentioned, some of which are confined to particular types or designs. If overstress is occurring, however, some of the foregoing signs will be in evidence to indicate the fact.

Which Rail to Gage on Curves

When regaging a curve, should the gaging be done on the inside or the outside rail? Why?

Depends on Wear on Rail

By E. L. Banion
Roadmaster, Atchison, Topeka & Santa Fe, Independence, Kan.

When gaging curves, the method to be followed will depend in large measure on the condition of the rail. If the rail is very little worn, the outer rail should preferably be gaged. On the other hand, if the rail is old and the inside rail is becoming rolled out from long service, I prefer to respike the outer rail and gage the inside rail to it. The reasons for this difference are that where the rail is much worn, the inside rail has a tendency to roll out and become straight, losing some of its curvature. For this reason, if the outside rail is gaged to it, there is a tendency to reproduce many of the straight sections in the outside rail. As a result, the first train over the newly gaged track will roll out the straight places, but instead of lining the rail in the process of smoothing it through the action of the wheels, the gage will again be widened to take care of the irregularities.

A good argument for gaging the outside rail is that it is the one that moves out of gage under the lateral thrust of the wheel flanges as a result of centrifugal action, while the inside rail receives no such lateral thrusts and, as a consequence, seldom moves out of gage. According to this theory, gaging the outside rail simply brings the two rails back into their original relation and position. Furthermore, if the outside rail is allowed to continue its outward movement, the spikes will in time become bent outward and lose much of their holding power. As a consequence, if one continues to gage the inside rail on curves where frequent gaging is necessary, the result will be that in time both rails will be off center with respect to the ties. Taking everything into consideration and to establish a uniform practice, it is my belief that, with the exception noted, the gaging of the outside rail is preferable.

The practice of maintaining sharp curves to standard gage is often a waste of time and money. Better results can be obtained if curves of 6 deg. and sharper are widened ⅛ in. for each additional degree until a maximum gage of 4 ft. 9¼ in. is attained. The widening of the gage in this manner will eliminate much of the regaging on sharp curves.

Double Spiking Interferes

By R. Rossi
R. Rossi & Son, Chicago

My experience leads me to the conclusion that there is a greater advantage in gaging the inside rather than the outside rail. In hot weather it is easier to gage this rail because one loosens rather than crowds the expansion, while the reverse occurs in gaging the outside rail. Again, on most curves the outside rail is double spiked. When these spikes are pulled in hot weather and an attempt is made to force the rail in to gage, there is real danger that it may buckle. In any case, this effort is quite sure to result in a kink at some point on the curve. Whether or not these results follow, the potential danger that they may is always present, while the cost of gaging the outside rail will, under these conditions, be about double that of gaging the inside rail. It should be kept in mind that one cannot always choose a convenient time for gaging curves, but must do the work at the time it is needed. For these reasons, I consider that the outside rail should be used as the line rail only on curves and the inside rail as the gage rail.

Favors Gaging Outer Rail

By L. A. Rape
Extra Foreman, Baltimore & Ohio
Wampum, Pa.

When regaging a curve, it is important that the line be inspected rather carefully. In many cases, if the outside rail is gaged, the apparent irregularities in line will be eliminated. The outside rail is the one which receives the pressure from the wheel flanges and which, therefore, is forced out of gage. On many curves there is no indication of outward movement of the low rail. This being so, it stands to reason that there is an advantage in bringing the rail which has moved out of gage back into its original position rather than to compel the low rail to follow it into a new position.

If the high or outer rail is gaged, much of the lining which would have been necessary if the gaging were done on the low rail will be eliminated, while a place "lined by gaging" may be expected to remain more stable than if the track had been disturbed by lining.

With the reduced forces that have been necessary for several years, and the increased speeds of operation, it has been advisable at times to change our practices somewhat. For this reason, we find it an advantage at times to gage the inner rail and afterwards line the track. This is safer because we avoid pulling so many spikes from the outer rail at one time where considerable gaging is necessary. On the other hand, it tends to increase the amount of work as compared to the former method.

Low Rail Is Gage Rail

By H. E. Herrington
Section Foreman, Minneapolis & St. Louis, Jordan, Minn.

My experience indicates that the high rail on curves should be the line rail and the low rail the gage rail. It is generally conceded that one cannot line the low rail with the same degree of accuracy as he can the high rail, particularly if the head has become feathered by the cold-rolling action of the wheels. Again, the wheel flanges pressing against the high rail tend to force it out. For these reasons, absolute gage is seldom maintained for any length of time, even on the best-maintained curves. It follows, therefore, that if the low rail is considered the line rail, the outer rail will reflect the inequalities of both gage and line, together with any irregularity in the side wear that may result from these inequalities, to the serious detriment of the riding qualities of the track.

Before a curve is gaged, the high rail should be made snug in the spikes and any kinked joints should be brought back into line. The curve should then be lined and gaged.

How Large a Suction Line?

Should a suction line serving a centrifugal pump be larger than the discharge line? A displacement pump? Why? If so, how much? How is this determined?

Reduce Friction Losses

By C. R. Knowles
Superintendent of Water Service, Illinois Central, Chicago

While no precise rule can be laid down, in general the proper size of a suction line will depend on the amount of water which must flow through it, the length of the line, their combined effect in creating friction losses and the static lift. The same general principles apply to both centrifugal and reciprocating pumps with respect to the size of the suction line, although the size of the line as it affects the suction performance is of greater importance to the centrifugal pump, because it is more sensitive to suction-line losses than a reciprocating pump is.

A suction pipe should never be smaller than the size given by the manufacturers. While opinions vary somewhat widely as to the methods for determining the correct size of the suction line for a given pump, experience has shown that the maximum velocity through a suction line should not be greater than 250 ft. per min. The length of the suction line should be kept to the minimum by placing the pump as close as practicable to the source of supply.

When it becomes necessary to install a long suction line, the size of the pipe should be increased. If this makes it necessary to use a suction line of larger size than the suction opening in the pump, an offset increaser should be used to avoid air pockets in the suction line. All suction lines should be air tight and free from air pockets, with as few elbows, valves and other fittings as practicable. Suction lines should be laid level or, preferably, with a fall from the pump to the source of supply. No part of such a line should rise above a direct line drawn from the suction opening of the pump and the surface of the water at the source of supply.

Foot valves should always be used on suction lines serving centrifugal pumps, and with other pumps where the suction line is long and the suction lift is more than 15 ft. An air chamber should be provided on a suction line serving a reciprocating pump if the suction lift is high, and it should be placed as close to the pump as practicable.

No General Rule

By J. H. Davidson
Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

There is no general rule which should be followed in making pump installations, but each case should be considered separately, and the most economical sizes for the suction and discharge lines determined by proper consideration of the governing factors. These factors are (1) the actual suction lift, (2) the friction in the pipe line and (3) the temperature of the water to be handled.

At sea level, the maximum theoretical height to which cold water can be raised by suction is 34 ft. Air leaks and friction reduce this so that for a reciprocating pump the practical lift is approximately 26 ft. At higher levels, this lift becomes less, until between elevations of 1,000 to 2,000 ft., the limit of practical suction is about 22 ft. for reciprocating pumps. For centrifugal pumps under the same conditions, the limit of practical suction lift is 15 ft.

For these reasons, when making a pump installation for handling cold water, the suction line must be of such size that the sum of the pipe-line friction and the static lift will be within the suction limits of the pump. It can be seen readily that in the case of a very short suction line with a low lift, the suction line can well be of the same size as the discharge line, but that if the suction line is long, there will be considerable friction loss, for which reason it will be advisable to increase the size of the suction line for the purpose of decreasing the friction.

Manufacturers of centrifugal pumps generally specify that they shall be installed so that the total suction lift, including the friction loss, shall not be greater than 15 ft. While reciprocating pumps can be operated successfully with greater lifts than centrifugal pumps can, it must be borne in mind that all pipe friction requires extra power to overcome it and that where this is a considerable item it is usually desirable to reduce it by installing pipe of larger size, as the saving in power will soon return the extra first cost of the larger pipe.

Where hot water must be handled, the conditions are different. When water is heated to 212 deg. F., it gives off vapor or steam at sea-level atmospheric pressure. At lower pressures, this vaporization occurs at lower temperatures. For these reasons, hot water cannot be raised as high by suction as cold water. If the temperature of the water is 120 deg. or higher, it should be delivered to the suction opening of the pump under pressure. A suction pipe delivering hot water should be of such size that the velocity of the water through it will not be greater than 2 ft. per sec., since at higher velocities part of the water will be vaporized and the efficiency of the pump will be somewhat impaired.

In any pump installation the size of the discharge line is not limited as definitely as that of the suction line. It should be kept in mind, however, that it should be of sufficient size to insure that the friction losses will not result in unnecessary operating costs.

New and Improved Devices

New Model Fairmont Inspection Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., is now offering its M19 one-to-four man inspection car in a new model (Series D) in which the outstanding deviation from previous M19 cars is that the new model has an aluminum alloy frame, the car as a whole embodying 89 parts of aluminum or aluminum alloy. As a result the weight of the

The New Model Fairmont Inspection Car

car has been reduced to 535 lb., while, with the extension handles pulled out, the lift required when setting the car off the track is 96 lb. at the rear end.

The new model also embodies a number of additional improvements as compared with previous cars. While the OD 5-to-8-hp. engine is the same as that used in the M19 series C car, the condenser in the new model is mounted on top of the water hopper in such a manner as to eliminate the need for hose connections. The axles in the new car are mounted on Timken roller bearings, each of which has two rolls operating on a single inner sleeve, while the thrust collars on the axles are of a special construction which does not involve the use of lugs.

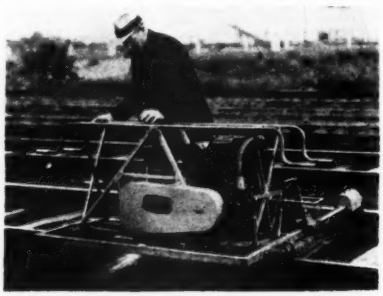
Another new feature involves the use of "Oilite" bronze bushings in the axle box guides, which are lubricated by a duct extending from the oil reservoir that surrounds each axle roller bearings.

Other new features include cast aluminum running boards (now standard equipment) between the wheels, which have a non-skid safety tread; larger tool trays with bottoms of 5/16-in. Haskelite Plymetl protected by steel lining; a cross seat for the operator which projects beyond the main seat on the left side of the car at the rear; and demountable wheels having 16-in. by ¼-in. demountable tires, in place of the 17-in. by ¼-in. tires used on the M19 Series B and C cars. It is pointed out that the 16-in. by ¼-in. tire fits the standard 8-bolt demountable hub.

New Nordberg Precision Grinder

A NEW type precision grinder for rail, known as the Model CG grinder, has been placed on the market by the Nordberg Manufacturing Company, Milwaukee, Wis. Essentially, the new machine comprises a cup wheel grinder driven by an 8-hp. gasoline engine, the entire mechanism being mounted by means of trunnions in a stabilizing frame with a flanged roller at each end and a third roller at the end of an arm extending to the opposite rail. To permit ready handling of the unit, a pair of tubular lifting handles is provided at each end.

The principal uses of this machine are for grinding welded rail ends, removing mill tolerance, leveling cropped rail and grinding out corrugations. In operation, the grinder is

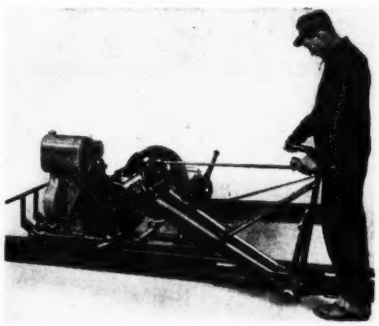


New Model CG Precision Grinder

rocked from side to side and at the same time moved back and forth along the rail, the mechanism being held normally in a vertical position by two coil springs attached to the stabilizing frame. The cup wheel can be so adjusted that the entire face of the wheel will contact the rail, or inclined slightly so that the grinding will be done by the front side of the wheel. The grinder is so designed that the wheel can be raised vertically without changing its position relative to the rail, thus permitting the rail to be tested with a straight edge without changing the setting of the wheel. Feed adjustments are made in increments of .0025". The outstanding feature claimed for this machine is its accuracy, as it is said that the ground surface obtained is comparable to that produced by machine tool grinding.

New Power Wrench

THE Nordberg Manufacturing Company, Milwaukee, Wis., has introduced a new power track wrench, known as Model BW, which embodies a number of improvements over the previous models put out by that company. The new machine is essentially similar to the earlier model; it is powered with a gasoline engine and the wrenching action is applied at the end of a wrench arm which can be swung from side to side to permit bolts on both sides of the rail to be reached with one setting



The Model BW Nordberg Track Wrench

of the machine. The engine unit is mounted on a truck having flanged rollers at each end with a third roller at the end of a guide arm extending to the opposite rail.

Among the important changes in design was the elimination of the two speed gear shift, the need for which has been obviated by replacing the 4-hp. engine of the earlier model with an 8-hp. air-cooled engine which provides enough power for heavy duty service without the need for a speed reduction. The weight of the new wrench is 400 lb., as compared with 725 lb. for the old model. In addition it is of more compact design. It is also said to be much faster than the old wrench and the controls have been so designed as to afford the greatest comfort for the operator.

The automatic overload release with which the new machine is equipped is said to assure a uniform tension in the bolts. Normally arranged to function automatically, the release is so designed that, should a frozen nut be encountered, it can be locked out by a simple movement of the control with the result that either the nut will be loosened or the bolt broken.

Burlington Orders Two More Zephyrs

Two more high-speed streamlined trains of the Zephyr type have been ordered by the Chicago, Burlington & Quincy from the Edward G. Budd Manufacturing Company, and will be placed in service between Chicago and Denver, Colo., in June on a schedule of 16 hr. for the 1,039 miles. Under this schedule the new trains will be 11 hr. 45 min. faster than the present westbound schedules and 9 hr. 15 min. faster than the present eastbound schedules. The average running speed between the two termini will be approximately 65 m.p.h., including 6 or 7 stops enroute. The new trains will have 12 cars each, with a capacity for 200 persons. With the inauguration of the Denver Zephyrs, the Burlington will have six such trains in service, including two between Chicago and the Twin Cities, one between St. Louis, Mo., and Burlington, Iowa, and one between Lincoln, Neb., and Kansas City, Mo.

Nation-Wide Air Express Service

A nation-wide unified air and air-rail express service providing highspeed shipping facilities to and from every point in the United States will be inaugurated on February 1, according to an announcement made by L. O. Head, president of the Railway Express Agency, on January 10 following a meeting with representatives of interested air lines. Through contracts signed by 20 of the 23 domestic air lines in the United States and the Pan American Airways with the Railway Express Agency, direct air-express service, with door-to-door pick-up and delivery, will be provided to 215 cities in the United States and Canada and to 32 foreign countries through the Pan American Airways System. In addition, through the use of combination air-rail service, all of the 23,000 Express Agency offices in the country become air express stations.

Rail Orders of the Month

Among the sizable rail orders placed during the last month, the Atchison, Topeka & Santa Fe ordered a total of 58,573 tons of rails including 47,157 tons from the Colorado, Fuel & Iron Company, 9,000 tons from the Carnegie-Illinois Steel Corporation and 2,416 tons from the Inland Steel Company. The Santa Fe has also ordered a total of 17,807 tons of track fastenings from various companies. Orders for 40,769 tons of rails and 10,000 tons of track accessories have been placed by the Southern Pacific, while the Wabash has divided an order for 10,000 tons of rails among the Bethlehem Steel Company, the Carnegie-Illinois Steel Corporation and the Inland Steel Company, and the Illinois Central has ordered 7,600 tons of rail, placing 3,000 tons with the Tennessee Coal, Iron & Railroad Company and 2,300 tons each with the Carnegie-Illinois Steel Company and the Inland Steel Company. In addition the New York Central received bids until January 29 for about 35,000 tons of steel rails and other maintenance of way materials.

Railway Earnings Show Sharp Upturn

For November, 1935, the Class I railroads of the United States had a net railway operating income of $54,234,305 which, for that month, was at the annual rate of return of 2.54 per cent on their property investment, as compared with a net of $32,540,502, or 1.51 per cent, for November, 1934. Operating revenues for November amounted to $301,330,508, as compared with $256, 975, 741 in the corresponding month of 1934, an increase of 17.3 per cent. Operating expenses totaled $218,583,400, compared with $196,986,279, an increase of 11 per cent.

For the first 11 months of 1935 these roads had a net railway operating income of $451,701,114, a return of 1.85 per cent on their property investment, as compared with a net of $426,462,593, or 1.74 per cent, in the corresponding period of 1934. Operating revenues for the 11 months totaled $3,154,269,797, compared with $3,014,059,031, an increase of 4.7 per cent, while operating expenses amounted to $2,367,770,363, as against $2,244,035,154, an increase of 5.5 per cent.

Shippers Anticipate Increased Carloadings

Freight carloadings in the first quarter of 1936 are expected to be about 6 per cent above actual loadings in the same quarter in 1935, according to estimates just compiled by the 13 shippers regional advisory boards. On the basis of these estimates, freight carloadings of the 29 principal commodities will be 4,677,608 cars in the first quarter of 1936, compared with 4,412,487 actual loadings for the same commodities in the corresponding period in 1935. Twelve of the 13 shippers' boards estimate increases in the loadings in their districts for the first quarter of 1936 compared with the same period in 1935, the only one estimating a decrease being the New England board which would have reported an increase except for an anticipated reduction of 30 per cent in shipment of potatoes. Of the 29 commodities included in the estimate, shipments of 25 are expected to show increases during the first quarter while decreases are anticipated for the other 4.

Railway Purchases in 1935

On the basis of preliminary reports of railway purchases for 1935, it is estimated that the fuel and supplies purchased by all railroads of the United States last year amounted to approximately $595,000,000, which is about $30,000,000, or five per cent, less than the purchases of these roads in 1934. The figure for 1935, however, was $50,000,000 above 1933 and $150,000,000 above 1932. Included in the total purchases for 1935 are about $33,290,000 for ties as compared with $39,700,000 in 1934; about $17,385,000 for rail compared with $33,000,000; $2,350,000 for track fastenings, frogs and switches; $7,500,000 for cement, brick and other building materials; and $18,000,000 for paint supplies and chemicals, including timber preservatives. Approximately $125,000,000 of the total spent for purchases in 1935 went for maintenance of way. While the purchases for the full year of 1935 were slightly under 1934, it is significant that, in line with the upward trend of carloadings during the latter months of the year, purchases also showed a tendency to increase during this period.

Highway Regulation Making Slow Progress

In spite of the fact that the motor carrier regulatory act was supposed to have become effective on October 1, 1935, so many motor carriers have delayed filing tariffs, schedules and other information required by the act that it has been necessary to extend from time to time the effective dates of the most important provisions of the act. The general effect of these postponements has been to require that tariffs and schedules be filed with the commission on or before March 2, 1936, and to require that the rates and fares as shown by the tariffs and schedules so filed become effective on April 1. Illustrative of the slowness with which highway operators are responding to regulation is the fact that, whereas each operator is required to file on or before February 12 applications for certificates and permits in order to preserve his rights to present routes, comparatively few have done so, even though the necessary forms were distributed a week or so before the first of the year. Partly in an effort to hasten the filing of applications, as well as to co-operate with motor carriers in preparing their applications and in other ways in connection with the administration of the law, the Bureau of Motor Carriers of the I.C.C. has sent about thirty of its representatives to visit the principal transportation centers of the country.

Association News

Metropolitan Track Supervisors' Club

The first meeting of the year will be held on the evening of February 20 at the Hotel McAlpin, New York, following dinner which will be served at 6:30 p.m. The subject to be discussed at the meeting following the dinner will be the heat treatment of rail.

Maintenance of Way Club of Chicago

Seventy-eight members and guests attended the meeting on January 22, when H. S. Clarke, engineer maintenance of way of the Delaware & Hudson, presented a paper on Continuous Rails Made Possible By Butt-Welding, which was illustrated by lantern slides. As a result of a questionnaire, in which the members were asked to express their preference as to the date of the club's meetings, it was decided to hold future meetings on the fourth Monday of the month.

At the next meeting, which will be held on February 24, A. L. Bartlett, engineer Maintenance of Way of the New York, New Haven & Hartford will described the marked changes in the organization of track forces that have been recently carried out on that road.

Bridge and Building Association

Arrangements are being made for the annual get-together luncheon of members who will be in Chicago during the A.R.E.A. convention in March. President T. H. Strate is also planning to call a meeting of the executive committee at that time.

Committees have been selected to study and report at the convention next October on eight subjects which, together with the committee personnel, follow:

Committee No. 1—Adapting Bridge Maintenance Methods to Today's Requirements for High-Speed Trains: G. E. Boyd (chairman), associate editor, *Railway Engineering and Maintenance*, Chicago; John L. Vogel (vice-chairman), bridge engr., D.L. & W., Hoboken, N.J.; W. F. Koehn, b. & b. mast., C.P.R., Montreal, Que.; R. W. Johnson, asst. engr., C.M.St.P. & P., Chicago; B. M. Whitehouse, gen. bridge insp., C. & N.W., Chicago; F. H. Cramer, asst. bridge engr., C.B. & Q., Chicago; C. E. Horrom, mast. carp., Alton, Bloomington, Ill.; W. A. Batey, sys. bridge insp., U.P., Omaha, Neb.; A. J. James, gen. fore. b. & b., A.T. & S.F., Emporia, Kan.

Committee No. 2—Maintenance of Railway Roofs: John G. Hancock (chairman), bridge engr., D.T. & I., Dearborn, Mich.; F. H. Masters (vice-chairman), asst. chief engr., E.J. & E., Joliet, Ill.; W. A. Stewart, dist. fore., B. & B., C. Vt., New London, Conn.; W. S. Rich, gen. fore., N.Y.C., New York; L. C. Winkelhaus, arch., C. & N.W., Chicago; E. L. Rankin, act. arch., G.C. & S.F., Galveston, Tex.; E. H. Brown, supvr. b. & b., N.P., Minneapolis, Minn.; T. D. McMahon, arch., G.N., St. Paul, Minn.; Thomas Stang, b. & b. supervisor., N.P., Spokane, Wash.

Committee No. 3—The Relative Merits of Different Species of Wood for Timber Bridges: George S. Crites (chairman), div. engr., B. & O., Punxsutawney, Pa.; A. E. Bechtelheimer (vice-chairman), asst. engr. bridges, C. & N.W., Chicago; H. G. Johnson, inst. man, C.M.St.P. & P., Ottumwa, Iowa; E. E. R. Tratman, civil engr., Wheaton, Ill.; C. S. Heritage, bridge engr., K.C.S., Kansas City, Mo; J. P. Yates, supvr. b. & b.., G.C.L., Kingsville, Tex.; C. D. Black, supvr. b. & b, S.P., SanAntonio, Tex.; W. F. Martens, gen. fore., b. & b., A.T. & S.F., San Bernardino, Calif.; J. P. Woods, supvr. b. & b., P.M., Grand Ledge, Mich.

Committee No. 4—Protecting Steel Bridges Against Brine Drippings: B. R. Meyers (chairman), asst. gen. bridge insp., C. & N.W., Chicago; Armstrong Chinn (vice-chairman), chief engr., Alton, Chicago; A. S. Krefting, chief draft., M. St.P. & S.S.M., Minneapolis, Minn.; H. Cunniff, gen. fore. painters, D. & H., Green Island, N.Y.; E. M. McCabe, supvr. b. & b., B. & A., Pittsfield, Mass.; W. G. Kemmerer, asst. engr., Penna., Chicago; E. B. Brown, asst. supvr. b. & b., M.P., Kingsville, Tex.; B. O. Johnson, asst. engr., C.M.St.P.& P., Chicago; A. W. Harlow, mast. carp., Erie, Huntington, Ind.; James Ferguson, div. engr., C.N.R., London, Ont.; C. Landstrom, mast. carp., C.B. & Q., Ottumwa, Iowa.

Committee No. 5—The Inspection and Maintenance of Water Tanks: R. E. Dove (chairman), asst. engr., C.M.St.P. & P., Chicago; C. R. Knowles (vice-chairman), supt. water serv., I.C., Chicago: A. L. McCloy, supvr. b. & b., P.M., Saginaw, Mich.; C. L. Metzmaker, supt. b. & b., C. & I.M., Springfield, Ill.; T. B. Turnbull, supt. b. & b., Ann Arbor, Owosso, Mich.; J. W. Porter, prin. asst. engr., C.N.R., Winnipeg, Man.; T. E. O'Brien, b. & b., mast., D. & H., Carbondale, Pa.; W. C. Harman, b. & b. supvr., S.P., San Francisco, Cal.

Committee No. 6—Underwater Repairs to Piers and Abutments: E. C. Neville (chairman), b. & b., mast., C.N.R., Toronto, Ont., T. W. Pinard (vice chairman), engr. b. & b., Penna., New York; L. R. Garman, b. & b. insp., Penna., Cleveland, Ohio; Maxfield Bear, gen. con. insp., C. & N.W., Chicago; G. W. Rear, engr. bridges, S.P. San Francisco, Cal.; G. L. Sitton, chief engr. m. w. & s., Sou., Charlotte, N.C.; W. H. Harrison, b. & b. mast., C.P.R., Toronto, Ont.; T. P. Soule, gen. supvr. b. & b., N.Y.C., New York; J. S. Huntoon, asst. bridge engr., M.C., Detroit, Mich.; J. G. Sheldrick, res. engr., M.St.P. & S.S.M., Minneapolis, Minn.

Committee No. 7—Rebuilding Our Bridge and Building Organization to Meet the Demands of the Recovery Period: W. B. Mackenzie (chairman), ast. bridge engr., St.L.-S.F., Springfield, Mo.; J.E. Bird (vice-chairman), asst. supvr. b. & b., N.Y.C., Corning, N.Y.; C. A. J. Richards, mast. carp., Penna, Chicago; V E. Engman, chief carp., C.M. St.P. & P., Terre Haute, Ind.; F. W. Hillman, asst. engr. maint., C. & N.W., Chicago; F. E. Weise, chief clerk, C.M. St.P. & P., Chicago; A. T. Hawk, engr. bldgs., C.R.I. & P., Chicago; W. H. B. Bevan, asst. dist. engr., C.N.R, Toronto, Ont; G. A. Rodman, gen. supvr. b. & b., N.Y., N.H. & H., New Haven, Conn.

Committee No. 8—Recent Developments in Preframing Timber Bridges: O. W. Stephens (chairman), b. & b., supvr., D. & H., Green Island, N.Y.; L.G. Byrd (vice-chairman), supvr. b. & B., M.P., Poplar Bluff, Mo.; C. M. Burpee, research engr., D. & H., Albany, N.Y.; J. F. Seiler, engr., A.W.P.A., Chicago; F. Lehrman, bridge draft, C. & N.W., Chicago; R. C. Henderson, mast. carp., B. & O., Dayton, Ohio; P. P. Lawrence, supvr. b. & b., St. L.S.W., Tyler, Tex.; V. S. Brokaw, inst. man, C.M.St.P. & P., Chicago; R. W. Cook, mast. carp., S.A.L., Atlanta, Ga.

Wood-Preservers' Association

At a meeting of the newly-elected executive committee following the adjournment of the convention on January 30, W. P. Arnold, chemical engineer, the Wood Preserving Corporation, Oreville, Ohio, was elected a member of the executive committee to fill the unexpired term of B. M. Winegar, elected vice-president.

At this meeting, the Executive committee also reappointed all but two of the chairmen of technical committees. E. H. Vrieze, Eppinger & Russell Co., Jacksonville, Fla., was appointed chairman of the associations committee on Marine piling service records.

Railway Tie Association

At a meeting of the Executive committee at Memphis on January 29, it was decided to hold the next annual convention at the Netherland Plaza hotel, Cincinnati, Ohio, on May 20, 21 and 22. Details of the convention program will be published in a later issue.

In our last issue an item regarding this association was published which was wholly incorrect at this date. This item was written some ten months ago, at which time the information was correct. In some unexplainable manner, it was not published at that time but appeared in this later issue, when the information was out of date.

American Railway Engineering Association

Preparations for the thirty-seventh annual convention, which will be held at the Palmer House, Chicago, on March 10-12, are rapidly taking final form. Bulletin 383, containing the third lot of the committee reports to be presented at the convention, will be mailed to the members early in February, while Bulletin 384, which will contain the remainder of the reports, will follow a short time later. An innovation to be carried out jointly by the Committee on Arrangements and

the Committee on Publications, at the suggestion of President R. H. Ford, is the preparation of a program booklet that will be mailed to all of the members early in February which, in addition to the complete program for each day's sessions, will contain a synopsis of the committee reports and an announcement of the exhibit of the National Railway Appliances Association.

The Committee on Arrangements, which held a meeting on January 20 and will hold another on February 4, is perfecting plans, in co-operation with Secretary E. H. Fritch that will insure the most expeditious conduct of the convention. A subcommittee has been appointed to co-operate with President Ford for the selection of the speaker for the annual luncheon for the members of the A.R.E.A. and the National Railway Appliances Association that will be held on Wednesday, March 11.

Only three committees found it necessary to hold meetings during the last month, namely, the committees on Rail and on Waterproofing, which met at Chicago on January 9-10 and January 16, respectively; and the Committee on Yards and Terminals, which met at New York on January 6. The Committee on Iron and Steel Structures will meet at Pittsburgh, Pa., on February 6-7 to lay plans for its work for the coming year.

Roadmasters Association

The proceedings of the convention which was held in Chicago last September are now in the hands of the printer and should be ready for distribution to the members in March.

President Chinn and members of the executive committee have appointed committees to investigate and report at the next convention on the following subjects:

Committee No. 1—Preparing and Maintaining Track for High Speed Operation: Walter Lakoski (chairman), div. engr. C.M.St.P. & P., Milwaukee, Wis.; R. L. Sims (vice-chairman), dist. engr. maint., C.B. & Q., Galesburg, Ill.; A. F. Kadow, div. eng., Alton, Bloomington, Ill.; E. L. Potarf, dist. engr. maint., C.B. & Q., Omaha, Neb.; J. H. Dunn, rdm., N.Y.C. & St.L.., Ft. Wayne, Ind.; E. C. Jones, rdm., C. & N.W., Milwaukee, Wis.; R. R. Nace, chief engr. m. w., Penna., New York; J. A. Snyder, rdm., M.C., Detroit, Mich.; E. P. Safford, supvr., N.Y.C., Silver Creek, N.Y.; N. Bridges, rdm., A.T. & S.F., Newton, Kan.; M. Donahoe, div. engr., Alton, Bloomington, Ill.

Committee No. 2—Selecting and Training Foremen: G. T. Anderson (chairman), rdm., K.C.S., Pittsburg, Kan.; L. M. Denny (vice-chairman), supvr. trk., C.C.C. & St.L., Indianapolis, Ind., T. N. Turner, rdm., M.P., Newport, Ark.; A. T. Darnell, rdm., G.C. & S.F., Ft. Worth, Tex., R. D. Copeland, rdm., Ann Arbor, Owosso, Mich.; C. T. Mulcahy, rdm., S.P., Niland, Cal.; J. A. Spulock, rdm., M-K-T., Franklin, Mo.; J. C. Runyon, supvr. trk., C. & O., Covington, Ky.; W. T. Eldridge, supvr., I.C., Vicksburg, Miss.; E. J. Brown, rdm., C.B. & Q., Chicago; A. R. Jones, div. engr., N.Y.C., Albany, N.Y., C. H. Higgins, asst. div. engr., B. & M., Dover N.H.; H. L. Barr, rdm., C. & N.W., Boone, Iowa; J. J. Clutz, supvr. trk., Penna., Trenton, N.J.,; G. B. Hickok, rdm., P. & S.F., Slaton, Tex.; J. Murphy, rdm., C.M.St.P. & P., Sioux Falls, Iowa; R. E. Meyer, rdm., C. & N.W., Wall Lake, Iowa; M. Donahoe, div. engr., Alton, Bloomington, Ill.; E. J. Ryan, trk. supvr., D. & H., Port Henry, N.Y.; W. H. Haggerty, trk, supvr., N.Y. N.H. & H., Harlem River, N.Y.

Committee No. 3—Inspection of Rail: C. W. Baldridge (chairman), asst. engr., A.T. & S.F., Chicago; J. B. Martin (vice-chairman), gen. insp. trk., N.Y.C., Cleveland, Ohio; W. F. Monahan, gen. trk. insp., S.P., San Francisco, Cal.; N. M. Gamble, supvr. trk, Wabash, Peru, Ind.; M. M. Killen, rdm., G.C. & S.F., Silsbee, Tex; S. Payson rdm., St.L.-S.F., Enid, Okla.; F. J. Liston, term rdm., C.P.R., Montreal, Que.; H. W. Stetson, gen. supvr., Me. Cent., Portland, Me.; A. B. Chaney, div. engr., M.P., Poplar Bluff, Mo.; J. J. Clutz, supvr. trk., Penna., Trenton, N.J.; O. R. McIlhenry, rdm., Tenn. Coal & Iron Co., Ensley, Ala.; I. D. Talmadge, rdm., N.Y.O. & W., Middletown, N.Y.; H. R. Clarke, engr. m. w., C.B. & Q., Chicago; J. G. Sheldrick, res. engr., M.St.P. & S.S.M., Minneapolis, Minn.; F. H. Masters, asst. chief engr., E.J. & E., Joliet, Ill.; G. L. Griggs, Jr., rdm., C.B. & Q., Centralia, Ill.; W. C. Pruett, asst. gen. fore. m. w. dept., M-K-T., Muskogee, Okla.; W. L. Spyres, rdm., K.C.S., Heavener, Okla.; G.H. Stople, supvr., B. & O., Callery, Pa.; W. J. Daehm, rdm., C. & N.W., Sparta, Wis.; L. E. Thornton, asst. div. engr., Alton, Bloomington, Ill.; P. F. Muller, rdm., C. & W.I., Chicago.

Committee No. 4—The Use of Work Equipment to Secure the Greatest Economy in Track Maintenance: R. W. Grigg (chairman), asst. supvr., Penna., Derry, Pa.; G. E. Boyd (vice-chairman), associate editor, *Railway Engineering and Maintenance*, Chicago; A. W. Wehner, rdm., S.P., Lake Charles, La.; P. Chicoine, rdm., C.P.R., Smith's Falls, Ont.; E. L. Banion, rdm., A.T. & S.F., Independence, Kan.; J. Morgan, supvr., C. of Ga., Leeds, Ala.; B. K. Shatto, supvr., B. & O., Willard, Ohio; William Hogan, supvr., B. & O.C.T., Chicago; J. R. Kanan., rdm., C.B. & Q., Hannibal, Mo.; B. C. Dougherty, rdm., C.M.St.P. & P., Chicago; F. L. McMillan, supvr., Alton, Joliet, Ill.; W. A. Moberly, rdm., C.M. St.P. & P., Chicago.

Committee No. 5—Curve Lubricators —Their Economy; Considerations Affecting Their Installation: H. E. Kirby (chairman), asst. cost engr., C. & O., Richmond, Va., O. V. Parsons (vice-chairman), asst. engr., N. & W., Roanoke, Va.; Jack Stewart, rdm., S.P., Yuma, Ariz.; Joseph M. Miller, supvr. trk., West. Md., Westminster, Md.; R. H. Carter, trk. supvr., I.C., Chicago; O. Surprenant, rdm., D. & H., Schenectady, N.Y.; G. C. Palmer, rdm., C.B. & Q., Kansas City, Mo.; A. L. Pollock, rdm., A.T. & S.F., Oceanside, Calif.; L. C. Martoia, supvr. trk., Penna., Niles, Ohio; L. T. Day, rdm., C. & N.W., Melrose Park, Ill.; Roy W. Putnam, rdm., S.P., Oakridge, Ore.

Personal Mention

General

W. D. Supplee, division engineer on the Philadelphia Terminal division of the Pennsylvania, with headquarters at Philadelphia, Pa., has been appointed superintendent on the Logansport division, with headquarters at Logansport, Ind.

Engineering

E. L. McDonald has been appointed acting assistant division engineer on the Atchison, Topeka & Santa Fe, with headquarters at Needles, Cal., to succeed **G. W. Varnum,** whose appointment as roadmaster with headquarters at Kingman, Ariz., is noted elsewhere in these columns.

F. P. Filipelli, supervisor on the New York division of the Pennsylvania, has been promoted to assistant to the division engineer on the Baltimore division, with headquarters at Baltimore, Md. **R. W. Riser,** supervisor on the Maryland division has been promoted to division engineer on the Renovo division, with headquarters at Renovo, Pa., succeeding **C. F. Trowbridge,** who has been transferred to the Philadelphia Terminal division, with headquarters at Philadelphia, Pa.

Chauncey S. Robinson, engineer maintenance of way on the Maine Central and Portland Terminal Company, with headquarters at Portland, Me., has been appointed assistant engineer maintenance of way on the Boston & Maine, the Maine Central and the Portland Terminal Company, with the same headquarters, reporting to the engineer maintenance of way on matters pertaining to maintenance, including maintenance of way standards; and to the chief engineer on construction.

H. N. Anderson, assistant engineer on the Pittsburgh West End division of the Baltimore & Ohio, with headquarters at Pittsburgh, Pa., has been appointed division engineer on the New York division, with headquarters at Tompkinsville, S.I., succeeding **J. L. Suesserott,** whose death on November 14 was announced in the January issue. **W. E. Kearfoot,** assistant division engineer on the Pittsburgh East End division at Connellsville, Pa., has been appointed assistant engineer at Pittsburgh, to succeed Mr. Anderson, and **H. A. Lynch,** track supervisor at Wheeling, W. Va., has been promoted to assistant division engineer at Connellsville, to succeed Mr. Kearfoot.

Incident to the consolidation of the various units of the Union Pacific System under the name of the Union Pacific Railroad, the titles of certain officers in the engineering department have been changed as follows: **G. J. Adamson,** chief engineer of the Union Pacific proper,

has been appointed district engineer of the Eastern district, with headquarters as before at Omaha, Neb.; **B. H. Prater,** chief engineer of the Oregon Short Line, with headquarters at Salt Lake City, Utah, has been appointed district engineer of the Central, Northwestern and Southwestern districts, with the same headquarters; **S. Murray,** chief engineer of the Orgeon-Washington Railroad & Navigation Company, has been appointed resident engineer of the Northwestern district, with headquarters as before at Portland, Ore.; and **R. L. Adamson,** chief engineer of the Los Angeles & Salt Lake, with headquarters at Los Angeles, Cal., has been appointed division engineer of the Southwestern district, with the same headquarters.

C. D. Merrill, whose promotion to division engineer on special duty in the office of the vice-president, traffic, on the Pennsylvania, with headquarters at Philadelphia, Pa. as noted in the January issue, was born on July 12, 1901, at Sullivan, Ind., and received the degree of B.S.C.E. in 1922 at Purdue University. He entered railway service on March 16, 1925, with the Pennsylvania, as assistant on the engineer corp on the Logansport division, and in 1928 was promoted to assistant supervisor on the Fort Wayne division. In 1930, he was transferred to the Philadelphia Terminal division, and in 1931, he was promoted to supervisor on the Sunbury division. Later in the same year he became, temporarily, assistant supervisor on the Philadelphia division. In 1932, he was appointed acting supervisor on the Williamsport division, and later in that year he was promoted to supervisor on the New York division. In 1933, he was transferred to the Philadelphia Terminal division, where he was located at the time of his recent promotion to division engineer on special duty in the office of the vice-president, traffic with headquarters at Philadelphia.

Donald C. Barrett, supervisor of bridges and buildings of the Madison division of the Chicago & North Western, whose appointment as division engineer of the Black Hills and Wyoming divisions was noted in the January issue, was born on December 12, 1879, at Norway, Iowa. Mr. Barrett first entered the service of the North Western on July 22, 1897, as a crew caller, and served in this position and as roadmaster's clerk, material clerk and chief clerk to division engineer until the fall of 1901, when he left the service to enter Iowa State College, from which he was graduated with a degree in civil engineering four years later.

Mr. Barrett returned to the North Western as a draftsman in the division engineer's office at Boone, Iowa, and during the following nine years he held the positions of rodman and instrumentman on location and construction, instrumentman on track elevation work in Chicago, draftsman and instrumentman on the construction of the passenger terminal at Chicago, assistant engineer on the construction of a new line in South Dakota, instrumentman in the valuation department and assistant engineer in the division engineer's office on the Galena division. In August, 1914, Mr. Barrett went with the Interstate Commerce Commission and served as assistant field engineer on federal valuation of the railroads and as cost engineer in the district office at Chicago. In April, 1920, he returned to the North Western as assistant engineer on the Eastern division, being transferred to the Wisconsin division in 1925. On September 1, 1927, he was made division engineer of the Minnesota division and in 1931 he was appointed supervisor of bridges and buildings of the Madison division, which position he was holding at the time of his recent appointment as division engineer of the Black Hills and Wyoming divisions, with headquarters at Chadron, Neb.

Track

Edwin M. Gambill, an extra gang foreman on the Atchison, Topeka & Santa Fe, has been promoted to roadmaster on the First district of the Missouri division, with headquarters at Shopton, Iowa, to succeed **Frank D. Smart,** whose death on November 20 is noted elsewhere in these columns.

W. M. Matheney has been appointed supervisor of track on the Cleveland, Cincinnati, Chicago & St. Louis at Mattoon, Ill., succeeding **H. P. Sullivan,** who has been transferred to Terre Haute, Ind., to succeed **George B. Walters,** whose death is noted elsewhere in these columns.

G. W. Varnum, assistant division engineer on the Atchison, Topeka & Santa Fe, with headquarters at Needles, Cal., has been appointed roadmaster with headquarters at Kingman, Ariz., where he replaces **R. D. Brown,** who has been transferred to Prescott, Ariz., to succeed **J. A. Rohrer,** who has retired.

L. H. Bond, Jr., who has been connected with the engineering department of the Illinois Central, with headquarters at Carbondale, Ill., has been promoted to road supervisor at Mattoon, Ill., succeeding **M. B. Davis,** who has been transferred to Kankakee, Ill., where he replaces **John Gallagher,** who has retired because of ill health.

L. L. Kerner, assistant on corps in the office of the engineer maintenance of way of the Baltimore & Ohio at Baltimore, Md., has been promoted to track supervisor at Weston, W. Va., to succeed **H. O. Hutson,** who has been transferred to Wheeling, W. Va., to replace **H. A. Lynch,** whose promotion to assistant division engineer is noted elsewhere in these columns.

Charles E. Wood, track supervisor on the St. Louis Terminal division of the Missouri Pacific, has been promoted to roadmaster on the Eastern division, with headquarters as before at St. Louis, Mo., succeeding **John Cross,** who has retired on pension. Mr. Wood was born on February 13, 1900, at Pike City, Ark., and entered the service of the Missouri Pacific on September 14, 1918, as a section laborer, being advanced to section foreman on the Arkansas division in 1922. In January, 1924, he was transferred to the Louisiana division and in 1926, he was made an extra gang foreman. Eight years later Mr. Wood was advanced to track supervisor of the St. Louis terminal, which position he held at the time of his promotion to roadmaster on January 1, 1936.

Emmett A. White, assistant roadmaster on the Chicago & North Western, whose promotion to roadmaster, with headquarters at Wall Lake, Iowa, was noted in the January issue, was born on February 24, 1896, at Belle Plaine, Iowa. Mr. White entered the service of the North Western on March 17, 1914, as a section laborer and during the following years he served successively as an extra gang timekeeper, welder, assistant foreman, foreman and extra gang foreman, being advanced to assistant roadmaster at West Chicago on April 15, 1935, which position he held at the time of his recent promotion.

Daniel W. Loftus, acting roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, whose appointment as roadmaster, with headquarters at Channing, Mich., was noted in the December issue, was born on March 30, 1906, at Delta, Iowa. Mr. Loftus entered the service of the Chicago, Rock Island & Pacific in 1923 as a section laborer and in the following year he went with the Milwaukee as an extra gang laborer, being made assistant extra gang foreman in 1925. After serving for a time as operator of a rail laying machine Mr. Loftus was advanced to extra gang foreman in 1927, being appointed section foreman in 1929, and terminal foreman in 1933. In 1935, he was appointed acting roadmaster, which position he held until his recent appointment as roadmaster with headquarters at Channing.

F. P. Pelter, whose promotion to roadmaster on the Norfolk & Western, with headquarters at Wilcoe, W. Va., was noted in the December issue, was born on July 13, 1907, at Lebanon, Tenn., and received his higher education at Virginia Polytechnic Institute. He entered railway service with the Norfolk & Western as a laborer on June 13, 1928, with headquarters at Bluefield, W. Va., and on July 7, 1929, was promoted to assistant foreman at Eckman, W. Va. On July 15 of that same year he was promoted to assistant roadmaster, with headquarters at Bluefield, and on June 15, 1931, he was transferred to Eckman. On October 1, 1932, he was transferred to Williamson, W. Va., where he was located at the time of his recent promotion.

A. R. Matteson, assistant supervisor on the Erie & Ashtabula division of the Pennsylvania has been transferred to the Philadelphia Terminal division succeeding **L. G. Walker, Jr.,** who has been promoted to supervisor on the Buffalo division to succeed **K. A. Werden,** who has been transferred to the Maryland division with headquarters at Wilmington, Del. Mr. Werden replaces **R. W. Riser,** who has been appointed assistant division engineer at Renovo, as noted

Bet On These Three Aces to Win . . .

VERONALLOY

TRACK CHISEL
SLEDGE
SPIKE MAUL

Here are track tools you can depend upon for extra service. They are made of Verona special alloy steel, heat treated in electrically controlled furnaces. Absolutely free from defects because they are checked by the *Verona Electric Polarizing Process* which discloses even the minutest flaws.

WOODINGS–VERONA TOOL WORKS

Verona, Since 1873 **Pennsylvania**

J. B. Strong has resigned as president of the **Ramapo Ajax Corporation,** a subsidiary of **The American Brake Shoe & Foundry Company,** effective January 30, at the age of 60 years. In the future he will act as a consulting engineer, particularly for the American Brake Shoe & Foundry Company and its affiliates in co-operation with its research department, with address 230 Park avenue, New York. Mr. Strong was graduated from the Sheffield Scientific School of Yale university in 1896, and in his varied career since that date, he has been instrumental in solving many railroad track and industrial problems. Immediately after graduation, Mr. Strong became interested in railway and industrial matters, especially relating to the design and manufacture of special trackwork, and has since been continuously active in this field. After having held various subordinate positions up to 1912, he was at that time made vice-president and general manager of the Ramapo Iron Works, predecessors of the Ramapo Ajax Corporation. When the latter company was organized in 1922, Mr. Strong was elected president and has since directed its policy of expansion and consolidation of plants. During the World War, as chairman of a committee of switch and frog manufacturers (members of the Manganese Track Society), he acted in an advisory capacity on standards for track work to the director general of railways. Mr. Strong participated in the organization of the Manganese Track Society in 1913, and has been active in its affairs since that time, having served as its chairman from 1927 to 1931. He has also been an active member of the American Society of Civil Engineers since 1904; of the American Society for Testing Materials since 1917; and of the American Railway Engineering Association since 1914. In the last named organization he has been particularly active, as a member of the Track committee since 1915, in the preparation of standard designs for special trackwork.

J. B. Strong

J. B. Spencer, vice-president of the **Southern Wheel Company,** has been elected president of the **Ramapo Ajax Corporation,** with headquarters at New York, to succeed **J. B. Strong,** who has resigned, as noted elsewhere in these columns. Both these companies are subsidiaries of the **American Brake Shoe & Foundry Company.**

Mr. Spencer was born on January 15, 1888, at St. Louis, Mo. He graduated from Yale university in 1910 and entered the employ of the Southern Wheel Company in January, 1917. A year later he was made assistant to vice-president and in March, 1921, he was elected vice-president, which position he will continue to occupy.

J. B. Spencer

George Dandrow has been appointed manager in the New York district for the Power Products and Industrial department of the **Johns-Manville Sales Corporation,** with headquarters at New York. Mr. Dandrow has been connected with this company since 1922.

Stanley H. Fields, vice-president of the **Koppers Products Company,** and a well-known figure in the wood-preserving industry, died on January 24 at his home in Pittsburgh, Pa., after a long illness. Mr. Fields was born on January 8, 1883, at Terre Haute, Ind., and after a high school education he entered the employ of the American Creosoting Company in 1905. In 1914, Mr. Fields became vice-president of the newly-organized American Tar Products Company, Chicago. This company was moved to Pittsburgh in 1925, and when it later became the Koppers Products Company, a division of the Koppers Company, Mr. Fields remained as vice-president.

Stanley H. Fields

Howard S. Johnson, who has been vice-president of the **American Hoist & Derrick Company,** St. Paul, Minn., for a number of years, retired from active service with this company and his place on the board of directors has been filled by **Rolf E. Ljungkull,** chief engineer of the company, effective January 1.

Trade Publications

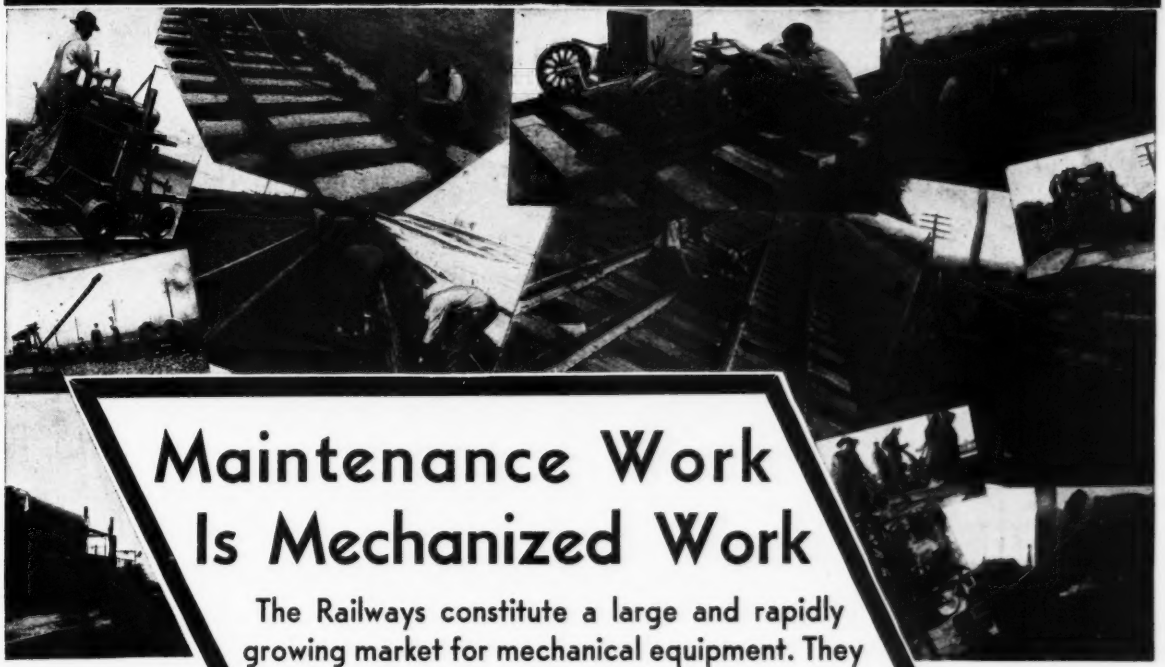
High-Speed Synchronous Motors—The General Electric Company, Schenectady, N. Y., has issued a 4-page pamphlet describing and illustrating its 7500 Series of high-speed synchronous motors.

Two-Stage, Air-Cooled Portable Compressors.—In a 56-page bulletin, No. 1604-E, the Ingersoll-Rand Company, 11 Broadway, New York, describes and illustrates its two-stage, air-cooled, portable air compressors, and its complete line of pneumatic tools for use with these compressors. Some of the more important tools covered include jackhammers, drifter drills, wagon drills, sharpeners and furnaces, jack bits, grinders, drill steels, drill mountings, hoists, tampers, riveters, chipping hammers, etc. The bulletin also includes reference to the stationary types of compressors furnished by the company both steam and electric driven, as well as stationary plant auxiliary units, such as coolers and air receivers.

What About Your Roofs?—This is the title of a brochure issued by the Johns-Manville Company, 22 East Fortieth street, New York, which deals comprehensively with the problem of roof construction and maintenance. Among the various subjects discussed are the importance of timely attention to roof repairs, the physical properties and characteristics of various types of built-up roofing materials, and the importance of expert application and inspection during roof construction. The brochure also includes a discussion of roof insulation and its effect in reducing fuel costs, and a description of a new roof unit, which combines steel deck, insulation and waterproofing in one unit structure.

CP Equipment for Maintenance of Way and Bridge Repairs.—The Chicago Pneumatic Tool Company, 6 East Forty-Fourth street, New York, has issued a 16-page booklet which describes and illustrates its two-stage, air-cooled portable air compressors and its pneumatic and electric tools for use in maintenance of way and bridge repair work. Some of the more important equipment and tools covered in the booklet include the two-stage, air-cooled compressors, with various mountings, tie tampers, wrenches, cut and screw-spike drivers, wood borers, rail and rock drills, riveters, grinders, and such bridge cleaning equipment as rotary wire brushes and scaling tools. The booklet also contains a complete list of the company's products.

TO RAILWAY SUPPLY MANUFACTURERS

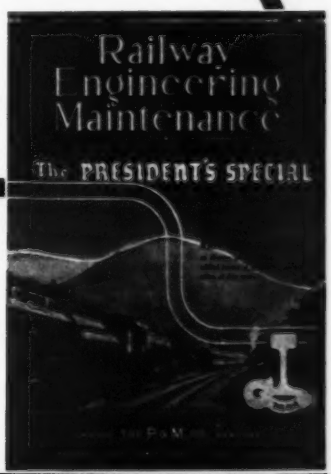


Maintenance Work Is Mechanized Work

The Railways constitute a large and rapidly growing market for mechanical equipment. They appreciate its advantages.

Maintenance officers are now planning their season's programs. They are, therefore, especially interested in equipment now.

The March issue of Railway Engineering and Maintenance, as for 18 years, will focus attention on equipment. It will feature its economies. It will contain the sales stories of many equipment manufacturers. Will yours be there?



FORMS FOR THE MARCH EQUIPMENT ECONOMIES NUMBER CLOSE FEBRUARY 24.

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

Section of Railroad Tunnel Under the East River, New York City, being waterproofed with—

Sika

Use Sika to stop the inflow of water through tunnels, basements, pump houses, man-holes, etc. Sika mixed with portland cement is easily applied by hand and will successfully seal off infiltration from underground streams even under pressure. Work which is carried out by our own force absolutely guaranteed.

Write us about your problems

Sika, Inc.

1943 Grand Central Terminal, New York City

Recommended Books on

RAILWAY ENGINEERING AND MAINTENANCE

The list is divided into four sections:

I. Engineering and Track—5 pages
II. Bridge Engineering—2 pages
III. Building Department—10 pages
IV. Water Service—1 page

The pages are 8½ x 11 inches, mimeographed. Free on Request—Specify sections.

Book Service Department

Simmons-Boardman Publishing Co.

30 Church Street, New York

Sent on approval for 10 days' FREE examination.

226 pages. 44 illustrations, cloth 6x9 inches, $2.00 postpaid.

Your Best Bet

The thinking man never disregards the practical value of reading such books as "Roadway and Track." This book covers in a sentence facts that theorizing would stretch to a page.

This condensation has permitted the author to do what few have done previously—make the least demand upon the reader's time in giving him the meat of modern maintenance practice.

Your best bet is "Roadway and Track" if you want facts you can apply to your own work.

You may keep this book for 10 days' examination without cost.

Send for a copy today.

Simmons-Boardman Publishing Co.

"The House of Transportation"

30 Church Street **New York, N. Y.**

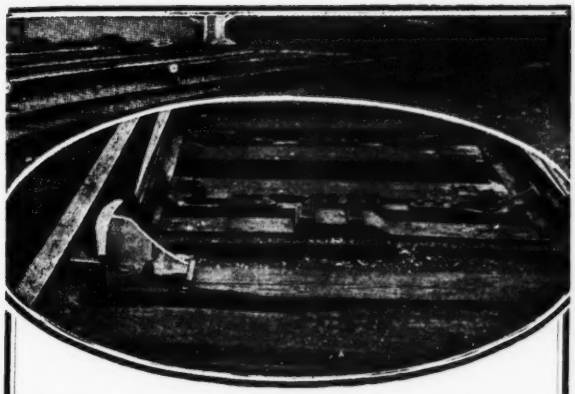
CUT *Devil* CHISELS

ECONOMICAL SAFE

◆

WARREN TOOL CORPORATION

WARREN, OHIO



Better Protection for Switch Points . . . Longer Life for Both Point and Guard . . . With the

TREGO Switch Point GUARD

Introduced by Morrison just a year ago the Trego Switch Point Guard has won universal acceptance with Class I Railroads. Repeat orders have definitely established Trego as a BETTER guard . . . with the following advantages:

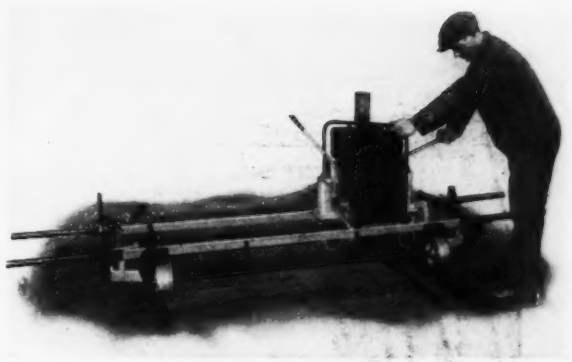
- Trego can be applied to worn stock rail. NOT necessary to replace worn switch point.
- Installation cost is the ONLY cost. Trego is ECONOMICAL.
- Trego will prolong the life of the switch point and cut maintenance costs.
- Lessens danger of "splitting the switch" because Trego draws the wheel flange away from the point.
- As the guard rail protects the frog point so the Trego guard protects the switch point.
- Trego has all the essential advantages of other protectors in addition to its OWN EXCLUSIVE FEATURES.

See TREGO on Display Next Month at the AREA Convention . . . Space No. 87

MORRISON RAILWAY SUPPLY CORP.

MORRISON BLDG.—BUFFALO, N. Y.

PITTSBURGH NEW YORK CITY CHICAGO
ST. LOUIS BRIDGEPORT WASHINGTON

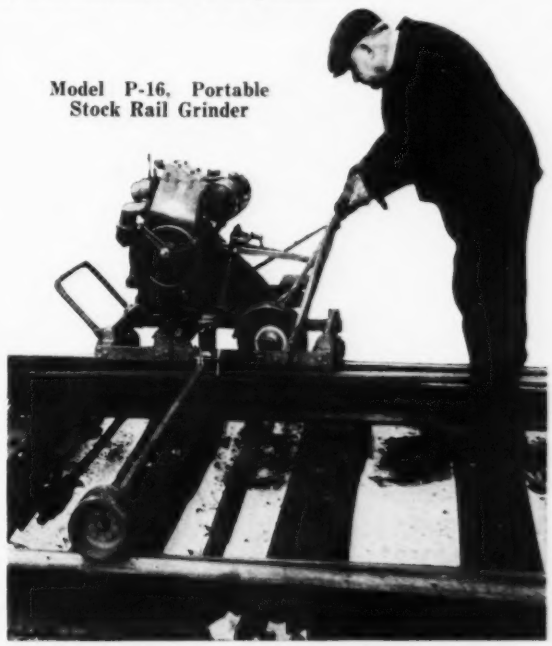


Model P-11, Rail Joint Cross Grinder

Economy in Rail Grinding

There's one way to achieve and guard economy in rail grinding—get equipment designed to do the job efficiently and stand the gaff while doing it. Railway Track-work grinders have proved on many railroads that they meet both requirements—they do a good job economically and can "take it" when it comes to hard, continuous service. What's more, the line is broad enough to offer you a choice of types to suit your ideas and requirements. Write for a complete set of data bulletins and see for yourself.

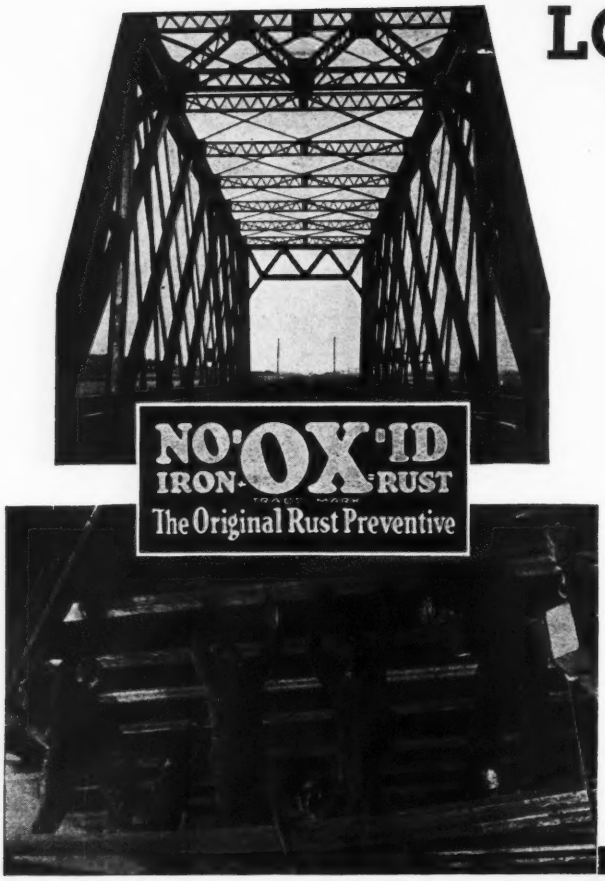
Model P-16, Portable Stock Rail Grinder



Railway Track-work Co.

3132-48 East Thompson St., Philadelphia

WORLD'S HEADQUARTERS FOR TRACK GRINDERS



LOWER MAINTENANCE COSTS

In maintenance of bridges and tanks and in building or reconditioning steel cars use NO-OX-ID for maximum protection. It eliminates costly cleaning methods, and functions to prevent loss of metal. There is a type of NO-OX-ID Rust Preventive that meets every service requirement. NO-OX-ID is easily applied and gives long time protection. Its use permits a 60% increase in maintenance work without a larger budget. Avail yourself of the saving NO-OX-ID can make for you.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave., CHICAGO 205 East 42nd St., NEW YORK
Canadian Factory and Offices: 2454-2464 Dundas St., W., Toronto

ALPHABETICAL INDEX TO ADVERTISERS

A

Air Reduction Sales Co. 56
American Steel & Wire Company 58-59
Armco Culvert Mfrs. Assn. 68

B

Barco Manufacturing Company 65

C

Carnegie-Illinois Steel Corporation 62
Columbia Steel Company 58-59
Cyclone Fence Company 58-59

D

Dearborn Chemical Company 110

E

Eaton Manufacturing Co. 54

F

Fairbanks, Morse & Co. 61
Fairmont Railway Motors, Inc. 57

I

Ingot Iron Railway Products Co. 68

M

Master Builders Co., The 112
Metal & Thermit Corporation 60
Morrison Railway Supply Corp. 109

N

National Lead Company 111
National Lock Washer Company, The 53
Nordberg Mfg. Co. 64

O

Oxweld Railroad Service Company, The 55

P

Portland Cement Association 63

R

Railway Track-Work Co. 109
Ramapo Ajax Corporation 70

S

Sika, Inc. 108
Simmons-Boardman Pub. Co. 107-108

T

Tennessee Coal, Iron & Railroad Co. 58-59
Toncan Culvert Mfs. Assn. 105
Truscon Steel Company 67

U

United States Steel Corporation Subsidiaries 58-59-62
Union Carbide and Carbon Corp. 55

W

Warren Tool Corp. 108
Woodings Forge and Tool Co. 103
Woodings-Verona Tool Works 103

...for sure protection use DUTCH BOY RED-LEAD

● Ceaselessly rust prowls about seeking its prey of unprotected metal—looking for places to get in its damaging work. Prevent this ever-present menace to metal from getting a foothold on your property by painting all iron and steel surfaces with Dutch Boy Red-Lead.

Paint made with Dutch Boy Red-Lead provides a solid, tough, tenacious coating—one that not only keeps out moisture but also resists the destructive action of other common causes of corrosion—such as gases, smoke and salt water.

Dutch Boy Red-Lead comes in both paste and liquid form, the latter including a quick-drying type for use when allowable drying time is short. The pigment in every case is pure red-lead that contains more than 97% Pb_3O_4, thus assuring easier application, higher spreading rate and a uniform film of greater density.

For complete information on protecting iron and steel against corrosion, send for our free booklet, "Structural Metal Painting." It covers such subjects as the conditions affecting the life of paint on metal, proper paint formulation, testing and judging the value of paint, estimating areas and costs.

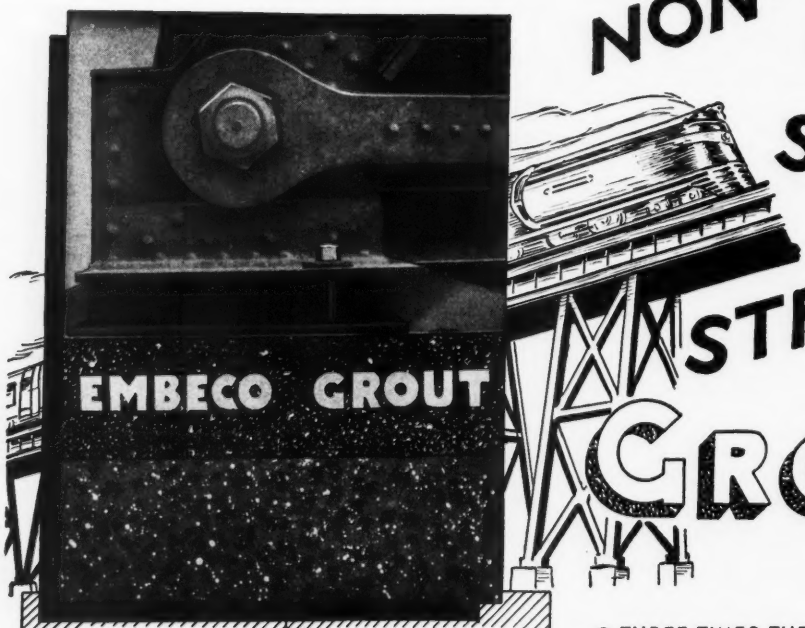
NATIONAL LEAD COMPANY

111 Broadway, New York; 116 Oak St., Buffalo; 900 West 18th St., Chicago; 659 Freeman Avenue, Cincinnati; 820 West Superior Avenue, Cleveland; 722 Chestnut Street, St. Louis; 2240 24th Street, San Francisco; National-Boston Lead Company, 800 Albany Street, Boston; National Lead & Oil Co. of Pennsylvania, 316 Fourth Avenue, Pittsburgh; John T. Lewis & Bros. Co., Widener Building, Philadelphia.

AMERICA'S LEADING RAILROADS SAVE MONEY • TIME • TROUBLE with

EMBECO

NON-SHRINK QUICK-SETTING HIGH-STRENGTH GROUTS



• *Shrinkage has been the major cause of ordinary cement grout failure. Poor contact between the grout and bed plate permits increased vibration with resultant rapid wear and disintegration. EMBECO NON-SHRINK creates an ideal bearing surface that stands up thru years of service.*

• THREE TIMES THE LIFE OF ORDINARY GROUTS! That's the record of Embeco performance in ten years of use in railroad bridge seat and turntable maintenance. Embeco's unusual advantages, its ease of application, its definitely superior lasting qualities have resulted in its becoming the standard specification for this type of work. Embeco grouts may be placed in use in from 30 minutes to 12 hours after pouring, as conditions demand. Embeco grouts cannot ravel or bleed . . . and in many instances this method has eliminated expensive shoring. For any heavy duty grouting job be safe . . . be sure . . . specify EMBECO.

Send for the complete facts on **Embeco.**

THE MASTER BUILDERS CO.
CLEVELAND, OHIO . . . TORONTO, ONTARIO